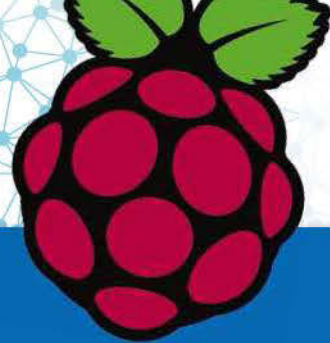


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Contents

This week...

18

The Death
Of Mozilla

08 Modding Old Computers

Have you ever wondered what a Commodore 64 might look like if you turned it into a bass guitar? Maybe not, but someone has, and actually done it. In fact, that's just one of many amazing computer mods David Crookes came across as he investigated modders, what they make, and why

18 The Death Of Mozilla

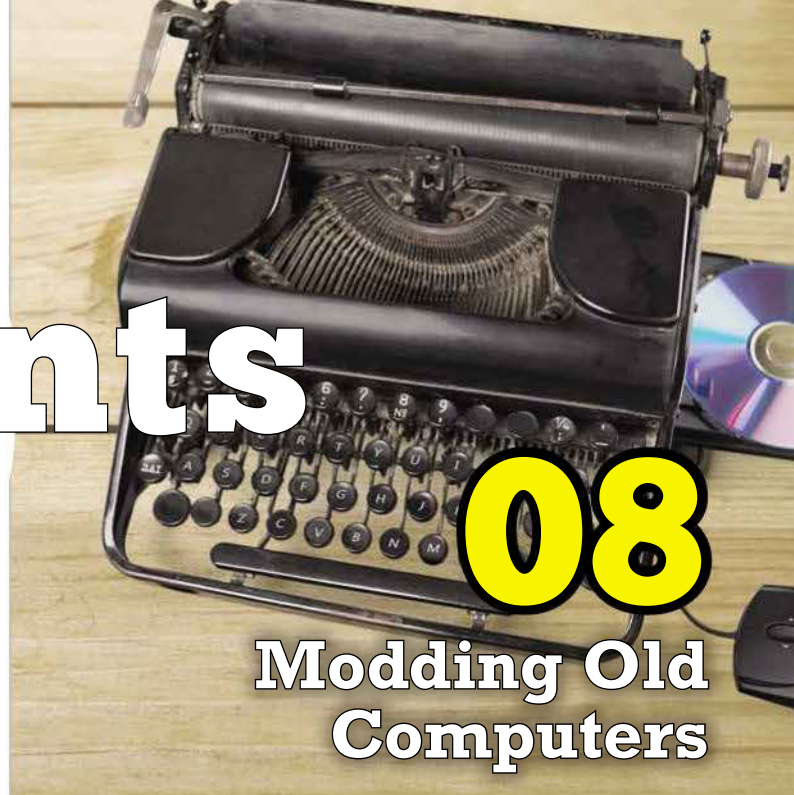
At one point, Mozilla was riding high with the hugely popular Firefox web browser and a well-regarded email client. Somewhere along the line, however, things went wrong, and more recent ventures have been less than successful. Could this really spell the end for Mozilla?

24 Has Amazon Cleaned Up Its Act?

As Amazon has grown, so too has its reputation for unethical business practices. The criticism its received over the years is hard to argue with, but have things improved? Sarah Dobbs takes another look at this giant of retail and sees whether its bad reputation is still justified

28 Top Tips: Google Calendar

Paper diaries are all well and good, but can they sync with your phone, tablet and PC? Can they send you reminders when an event is coming up? No, they can't – but online calendars can. Google has one of the best around, and Roland Waddilove shows us how to get more from it



Modding Old
Computers



The Death
Of Mozilla



Has Amazon
Cleaned Up
Its Act?

50 Raspberry Pi Kits

58 Graphics Cards For VR

50 Raspberry Pi Kits

The Raspberry Pi is a great piece of kit, even if you never do anything more with it than use it to run a media centre program. However, if you want to take things to a whole new level, then you don't have to look hard for kits that enable you to do so. We've been looking at six kits this week, to get an idea of what's available

58 Graphics Cards For VR

Virtual reality looks set to become a mainstream success, with the first consumer headsets now hitting the market. Right now, though, you need deep pockets to afford one, and you also need a powerful PC. Central to that, of course, is a high-end graphics card, and Aaron Birch is here to help you choose the right one

64 Gadget Gifts

Does a tech geek in your life have a birthday coming up? Or do you just fancy treating yourself to something? We've picked eight of our favourite budget gifts for gadget lovers, ranging from the genuinely useful to the slightly ridiculous – and they all cost less than £35!



Also In This Issue...

34 Component Watch

Join James Hunt as he introduces another selection of deals

57 Top 5

We nominate five tech products that were before their time

66 Alphabet Pi

This week, it's all about the letter 'H'

67 Remembering

Do you remember the *Fighting Fantasy* series? David Hayward does

86 Crowdfunding Corner

Do either of this week's campaigns deserve your backing?

87 App Of The Week

It's time for some Spectrum games, with PlayZX

Buyer's Guide

Raspberry Pi kits

- 50 FUZE
- 51 Maplin Raspberry Pi Advanced Kit
- 52 ModMyPi Ultimate Raspberry Pi Kit
- 53 SK Pang Raspberry Pi Starter Kit-C
- 54 The Pi Hut Raspberry Pi 3 Starter Kit
- 55 U:Create Raspberry Pi 2 Model B Camera Kit

Reviews

- 42 ASUS VivoBook Pro N552VW
- 43 ScanJet 2500F1
- 44 Asus ROG Sica Mouse
- 45 SanDisk Extreme Plus Micro-SDHC UHS-1 Card
- 46 Western Digital My Cloud EX2 Ultra NAS Box 8TB
- 48 Dell Venue 10 Pro 5056
- 49 AC Worldwide Star Wars Bluetooth Speaker

Experts

- 82 Ask Aaron
- 84 Ask Jason

Specialists

- 68 Linux Mart
- 69 Amiga Mart
- 70 Mobile Mart
- 71 Hardware Mart
- 72 Gaming Mart

News

- 36 The Latest News
- 56 Your Letters

Regulars

- 30 Subscriptions
- 74 Ad Index
- 76 IT Essentials
- 78 Classifieds
- 88 Logging Off



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Mod Your Old Computers

David Crookes looks at how you can give a retro machine a brand new lease of life

We are constantly discarding the old in the pursuit of the new. A new phone comes out and suddenly the last one is old news, even though it's worked perfectly well for the past year and probably will into the next decade. A new update appears on the computer, and scores of us decide to upgrade for no reason other than the fact that it's there and we're curious. Developers of numerous websites from Facebook to Twitter make tweaks just to refresh things, usually leading to an outcry about an icon or something, but then we carry on as normal again.

It can be quite cathartic to take a step back from the relentless grind of always trying to be at the cutting edge, to look at a technology that predates the current trends and which seemingly offers you a sense of stability. If you think back to the days of the 8-bit computers (assuming you're old



▲ Benjamin Heckendorn's portable Colecovision

enough, of course), you'll recall a time when you could just turn on a machine, have it instantly boot and then stay in that state. There were no prompts for updates, no need to upgrade for years. It's refreshing to peer through those rose-tinted specs and even the most jaded of eyes will light with delight. And then the 'what ifs' hit you.

“ Not all mods have to alter the physical form of a computer ”

Steady can be boring. Sure, if it ain't broke, don't fix it, but change isn't all that bad – especially if you have a piece of tech knocking around that you haven't touched for ages but want to spring back into life. There are ways to take your Spectrums, Commodore 64s, Amstrad CPCs, games consoles and even peripherals to the next level, making them do things that your younger self wouldn't have considered doing for various reasons – perhaps cost or because you were worried about breaking something. Today, though, you may find the circumstances are just right and that modding is something you'd like to try.

Some practitioners of this techy art have made something of a name for themselves. Among them is Benjamin Heckendorn, who runs the website benheck.com. He has become a celebrity 'maker' thanks to retro computer and console mods which are impeccably carried out, his skills having been honed over the past 20 years or so. He thinks nothing of prising open a ZX Spectrum and getting stuck in, replacing the innards or adding fresh parts as he seeks to re-form or repurpose it. For a good section of the retro community, this is akin to murder, but get an old, broken machine, and this becomes a very cool hobby indeed.

With a bill of skill and ingenuity, it's possible to turn Commodore 64s into laptops or produce handheld versions of 8-bit or 16-bit machines, complete with screens. As Heckendorn shows, you can enhance the original tech and produce something unique and inspiring. Having snapped up original Z80 chips from eBay before wiring them to prototype boards using circuit designs obtained from worldofspectrum.org, Heckendorn's ZX Spectrum portable ended up being 2,000 times faster than Sir Clive Sinclair's classic, running at 2GHz quad-core rather than 3.5MHz. Games could be copied to the machine via a connected tablet, but the beauty of it was that it deliberately retained the loading times.

A quick look at his site shows just how prolific Heckendorn is. He's produced a battery-powered Colecovision Portable and a N64 portable. He's taken a NES and shrunk it down to a near Game Boy Advance Micro size. He's worked with PlayStations, combined a NES with an Atari 2600 (which is able to play games from both systems), and he's performed all kinds of magic using an Xbox 360 console. All of which, of course, takes a lot of time and patience and won't be for the faint hearted. In many ways it's like playing around with a Raspberry Pi but with far older tech and with perhaps less certainty about what you may achieve.

Basic Modding

Not all mods have to alter the physical form of a computer. There are some mods you can perform quite easily that simply build on what you already have. One of the simplest things you can do with an Amstrad CPC, for example, is expand the memory. Scouring eBay for a 256k Dk'tronics memory expansion would do the trick on a 6128, but you can take a cassette-based CPC 464 to 128k with a 64k pack – arguably the most useful of the two because it would allow your machine to enjoy the games that were originally made for the disc-based computer. It's also possible to hook a 3.5" drive



▲ Companies such as Dk'tronics sold devices including this 64k memory expansion for the Amstrad CPC 464. It's worth looking on eBay for what amounts to a plug-and-use mod

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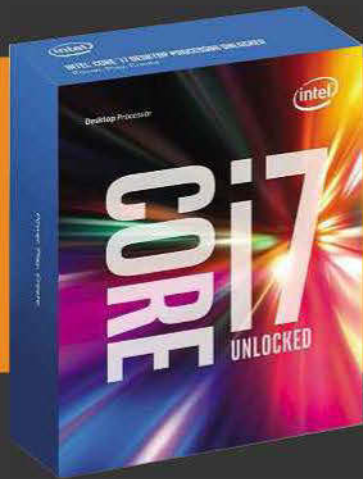


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The Breadbox

Lau 'MtnBuffalo' Brix runs the blog breadbox64, in which he shows how you can enhance your gaming experience on a Commodore 64 by modding it.

Micro Mart: What was your first Commodore 64 mod?

Lau Brix: It was a 'Switchless JiffyDOS mod' of one of my first breadbox machines. JiffyDOS is an enhanced Disk Operating System (DOS), which decreases loading times up to a factor of 10, and files written while in JiffyDOS are identical to those made on stock systems. To attain the faster reading and writing speeds of JiffyDOS, the original Commodore Kernal ROM chip on the motherboard has to be exchanged (as well as the DOS ROM on the disk drive). This has several advantages, as it does not take up any of the rear side ports of the machine or require special cabling as other hardware fast loaders. If data cannot be loaded or executed using JiffyDOS, or if the cassette deck is being used, a simple switch is usually drilled into the cabinet to toggle the software on and off.

MM: What motivated you to do it?

LB: The motivation for the mod was the increased speed of JiffyDOS. Newer data storage devices for the C64, like the SD2IEC, supports JiffyDOS natively, and no further modifications are needed to speed things up. But to toggle the software on and off, a hole had to be drilled into my precious machine (getting un-scratched, not-partly-broken and non-yellowed machines is quite hard these days!). To circumvent the problem, a guy from Italy has made a little PCB containing both the original Commodore 64 Kernal and JiffyDOS. Pressing the RESTORE button during power up will boot the system into JiffyDOS. If nothing is pressed during power up, the machine boots into the standard Commodore Kernal. No need for drilling holes! The mod is quite easy and involves removing a large 24-pin IC from the motherboard and replacing it with the small 24-pin PCB. The mod is finalised by soldering two cables to specific locations on the motherboard.

MM: What's your favourite C64 mod?

LB: I really like the 'SD2IEC mod'. The SD2IEC is a mass storage device that uses a SD card for data storage and interfaces with the IEC bus of the Commodore 64 (the same port as one would connect an 1541 disk drive to). The most common use of the SD2IEC is as a replacement of a Commodore 1541 disk drive. It doesn't emulate



the disk drive completely like the 1541 Ultimate II does, but it reads quite a few .d64 and .prg files. And most importantly, it supports JiffyDOS natively!

MM: How important is the Raspberry Pi to the modding scene?

LB: I actually did the C64 RaspberryPi mod on my site before I even got a real Commodore 64. The Raspberry Pi allows for an easy and cheap way to mess around with emulators of old computers and consoles without the hassle of actually buying the original gear and games; just getting an image out of an old gaming console using a modern TV can be a challenge for the average user. I guess using the Pi in an original case (like the C64 or any other retro computer) awakens something in people who were young in the 80s.

MM: What can modding do for retro game fans?

LB: I got back into the retro-gaming scene when I built a MAME upright arcade machine a few years back. I found myself spending most of the time playing C64 games in VICE (a C64 emulator for playing games on a PC) and decided to get some real Commie hardware. I soon realised my passion was repairing, fixing, modding, collecting, hacking and so on.

The 'easy' part of modding the C64, compared to today's computer hardware, is that the components are big and easy to handle (soldering is quite easy), and fault finding can often be done with a standard multimeter, programming of IC chips can be done with cheap EPROMs and burners from China, and the C64 community is huge, so help is never too far away.

to a CPC, which makes sense given that you can still get hold of 3.5" floppies far cheaper than you can the proprietary 3-inchers.

The CPC Wiki (www.cpcwiki.eu/index.php/DIY) lists a host of DIY projects you can carry out on one of Lord Sugar's finest machines. And as with many 8-bit computers, the CPC has a strong hobbyist fanbase, which began to form before the machines became obsolete, and has continued ever since. At CPC Wiki you'll find ways of connecting an Atari ST mouse and trackball to an Amstrad and figure how to get hold of ROM/RAM expansion kits. You'll be able to discover how to get a CPC to work with an LCD or plasma television.

But there are some more difficult mods that will expand the machine's internal capabilities. It's possible to replace the 16MHz crystal of a CPC with a 24MHz crystal so the overall speed of the computer is boosted from 4MHz to 6MHz. You can also convert the 464 Plus machines to a 6128 Plus. Yet the Amstrad isn't a special case, by any means: any computer can be altered. "You'll see significantly more mods if the computer is powerful," says Brian Benchoff, who writes for the website **Hackaday.com**. "The Apple II was a great machine for its day, but that was in 1979. The 80s brought us the Commodore 64, and that's still a very popular modding platform."

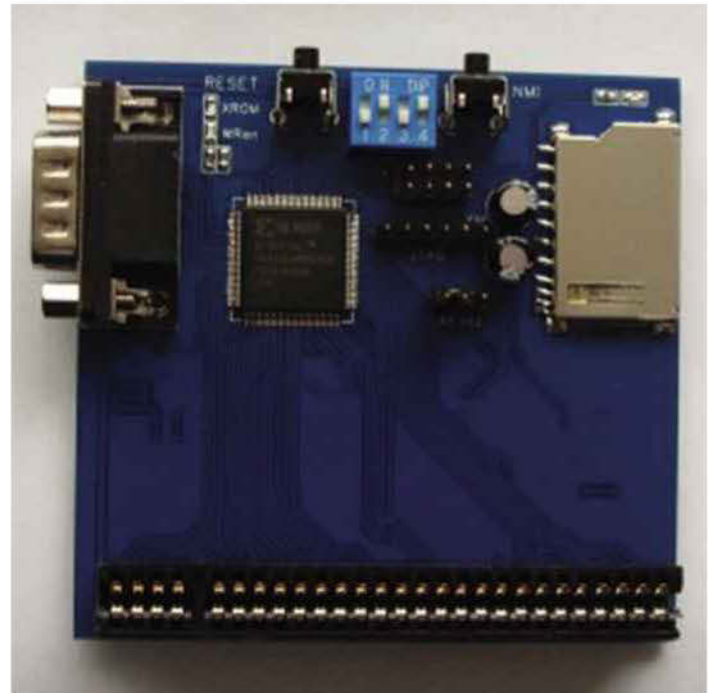
You can upgrade a Dragon 32 to 64k or slap an expansion board onto a ZX Spectrum to add a multi-ROM switcher, a SD card slot, reset button and Kempston compatible joystick interface (www.retroleum.co.uk/20150702/smart-card-make-over). You can replace the 6510 or 8502 CPU of a Commodore 64 with a 16-bit 65816 (www.baltissen.org/newhtm/10to816.htm). Indeed, fans of the C64 may want to try the IDE64 Project (www.ide64.org), which allows you to add an IDE drive, CD or SD/CompactFlash memory cards to a Commodore 64. It fits into the expansion port and offers a transfer rate that is 100 times that of the floppy drive 1541.

"Expansion slots in the Commodore 64 mean you can easily add Ethernet to your old machine," says Benchoff. "If you don't have the old Commodore disk drive, just grab yourself an SD card adapter. If you're more of a Macintosh fan, there

“ I’ve seen an Intel 4004 development system get on the Internet ”

are adapters to turn SD cards into huge floppy drives." EasyFlash is a cartridge with 1MB flash memory, which slots in the C64 expansion port and allows game progress to be saved or new functionality to be added. You can make one for around £20.

Of course, there may seem little point in modding machines; after all, we have far more powerful machines around. But it's fun and, as Leicester City fans will tell you, everyone loves a tinkerer. Playing around with a retro machine refreshes older technology that you may otherwise be looking to discard or stick in the loft, and there are loads of opportunities for anyone seeking a project. You can easily lose an entire evening scouring the web for new things to do, looking back over projects that people were performing back in the day. (Check



▲ Retroleum.co.uk has these SMART cards for the ZX Spectrum, which expand the computer's capabilities

out www.sentex.net/~mwandel/tech/index.html, for instance, for Matthias Wandel's C64 DIY projects.)

On top of that, the retro market is very well catered for, so if things go wrong, there'll be someone on hand who can steer you in the right direction. Even if all you want to do is return a machine to its former glory, you'll find replacement keyboards, drive belts and even spanking new cases created from the original moulds. It's certainly clear that there's still a lot of life left in those machines. "Any retro computer can be pushed as far as you want," says Benchoff.

"I've seen an Intel 4004 development system – a system meant to develop calculator software using a chip made in 1971 – get on the internet. This was an amazing kludge that used more silicon in the Ethernet-to-serial chip than the CPU, but it can be done. Apple IIs play movies, Commodores can browse the web, and Speccys can tweet. At this point it's not really that an 8-bit can approach the capabilities of a 16-bit or 32-bit system; any computer can do anything if you put in the work to do it. The only difference, really, is how fast it does it."

Cheaper Shapeshifters

Modding old machines has been a 'thing' for quite some time. Just under 20 years ago, Simon Archer wanted to own a Commodore Amiga laptop, so he converted his Amiga 600 into what he called Suzanne. Revealed in the October 1997 edition of CU Amiga Magazine, it was fitted with an Apollo A620 28MHz 68020 accelerator with 8MB Fast RAM and a CD-ROM drive. Other portables have been created too, from the SX-Amiga (built into an old SX-64 case) to Volker Mohr's portable A1200 in a wooden case. The A1200 has also been placed into a tower case.

But even smaller form technology has proven useful to modders. It is possible to grab an old mouse and make it Bluetooth enabled for no other reason than to get something that works well but looks rather nostalgic. Simply grab retro



▲ Jeri Ellsworth showcases her Commodore 64-inspired musical instrument on YouTube

Changing The OS

Jörn Mika has spent more than 15 years producing an alternative operating system for the Amstrad CPC called SymbOS, which can also run on other machines. He talks to us about its development.

Back in the 1980s, Berkeley Software produced a windows-based operating system for the Commodore 64 called GEOS, which astounded many users. Similar projects were created for other computers with mixed success, but one, SymbOS, has been attracting attention from those still using an Amstrad CPC. The computer used its own OS in combination with AmsDOS, and it could also run CP/M, but SymbOS brings a great-looking GUI to the machine. It also works on the PCW and MSX, and it can be downloaded at www.symbos.org.

Micro Mart: What is special about SymbOS, and how does it better the CPC OS and CP/M?

Jörn Mika: SymbOS has some things which probably have never be seen on 8-bit home computers before. Its flexible Windows 95-like GUI is pixel-based and supports even updates of overlapped forms, but it's still faster than most other 8-bit GUIs done before. It runs in 2, 4 and 16 colour modes and supports any kind of resolution. You can run up to 32 tasks with eight different priorities; the execution of 24 applications at the same time is possible. There's even an idle task, which is used for measuring the free CPU time, and a task manager. Memory expansions aren't used as RAM disks like in the usual 8-bit OSs, for the whole RAM of up to 1MB is used for executing applications, which are relocatable to any place in memory. Last but not least, SymbOS supports all FAT file systems from FAT12, FAT16 and FAT32.

MM: Why the CPC?

JM: Due to its flexible but still limited memory banking system, it was already possible to introduce a dynamic memory management with support of up to 576KB (later 1024KB) RAM for programs and data. If I had chosen the ZX Spectrum, the system had to be designed in a much more limited way. And if I had chosen the MSX or the Amstrad PCW, which have a more powerful RAM banking, it would be impossible to port it to the Amstrad CPC. The different screen modes of the CPC also forced me to build low-level screen drivers, which then made it possible to support any kind of resolutions and colours.

MM: What do people need to run it?

JM: SymbOS runs on a standard CPC6128, MSX2, PCW256 or EP128 (+floppy disk), but for such unexpanded systems, it can be more seen as a demo, as you won't be able to start more than three little apps at the same time or use nice features like desktop background pictures, screensavers and other extensions. You will have real fun with 256K or more and, of course, it's really great if you have something like a hard disk, CF or SD card attached to your machine. The best expansion for the CPC is still the SYMBiFACE II card, which now has a successor called X-MASS and X-MEM. For the MSX you have many different memory expansions and mass storage hardware, and even for the Enterprise there's an SD card interface and internal memory expansion solutions.

MM: What is the future and your hopes for it?

JM: One of the very interesting things is the network capability of SymbOS. Since last year, there's a network daemon available for SymbOS, which allow applications to connect to the internet even at the same time. So you can start a Telnet client, a messenger and a network game all at the same time, which all have their TCP/IP connections. My hope is there will be Ethernet hardware available for the Amstrad CPC and Enterprise as well (like we already have for the MSX) and that we'll see more network apps for SymbOS, as this a fascinating thing for an 8-bit.



and modern mice and swap the circuit board and other internal parts. NES game controllers can be converted to USB (and even have Raspberry Pi Zeros inserted into them; slap on a retro emulator and you have a portable device you can plug into your television to play classic games). Floppy disks can come in handy too: how about making a pen holder out of some old unusable 3.5" disks? If this is your bag, go to www.instructables.com/id/Floppy-Disk-Pen-Holder.

But back to 'proper' tech, and the Commodore 64 Direct-to-TV joystick has become a very popular device to mod. Released in 2004, it's a rather valuable bit of kit, fetching around £100 on eBay, but if you do feel tempted to open it up, you can be inspired by people who have connected a keyboard, incorporated an SD card interface, added a floppy drive and even inserted extra joysticks. In most cases, only

basic soldering skills are needed, and it makes it a very good starter modding project for relative novices to try (head to jledger.proboards.com/board/4/dtvhacking for a good flavour of what's been done).

"I was very, very impressed with a particular mod for the Nintendo Entertainment System," says Benchoff, of a system you can pick up on eBay for around £30. "The NES had a small port on the bottom – an 'expansion port' – that was a holdover from the original release of the Famicom in Japan. This port wasn't used for anything, and for two decades was just a mysterious unused port on the bottom of the most popular game console of all time. About a year ago, someone came up with the idea of making this port do something. They made an NES Tweet through the expansion port. Most of the heavy lifting was done through a microcontroller and a tiny

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▲ The NES was used to send a tweet showing how you can update systems for modern needs

“ Any retro computer can be pushed as far as you want it to ”

bit of RAM that serves as a buffer between the NES and the supporting circuitry.” The mod can be seen at www.trappz.com/?p=14.

Music To Your Ears

When it comes to modding old computers, you really are only limited to your imagination. A video emerged on YouTube in 2012 (www.youtube.com/watch?v=_kDhpFaf4EY), which showed how a Commodore 64 – infamous for its brilliant SID 6581 sound chip – had been turned into a bass guitar. Jeri

Ellsworth showcased her device at the Maker Faire, whizzing around on roller skates as she rocked out some top tunes.

“The sound of the Commodore 64 sound chip is quite special,” says Jesper Holm Olsen, from the band Press Play On Tape, which was started by a group of university computer science students more than 15 years ago in Copenhagen. “It is thin, but powerful and raw all at once. And slightly hissy and distorted in a way that our parents hated but we learned to love. The sound is still so distinct that fans of Commodore 64 music are able to recognize that sound chip anywhere it’s being used, even if it just for a small effect in a piece of modern pop music.”

David Terrill created a music-based mod on the C64 called Alpha, which adds a secondary sound chip. 1.4” audio, stereo input, audio feedback and more. It can be seen at www.bigmech.com/misc/c64mods/enclosure.html. Use it in combination with the MSSIAH Cartridge and you can turn your C64 or C128 into a MIDI synthesiser. It costs €49.95 from mssiah.com. Before you do, you may also want to dust off your old Game Boy. This 118.69 million seller can be picked up cheaply, and musicians love it.

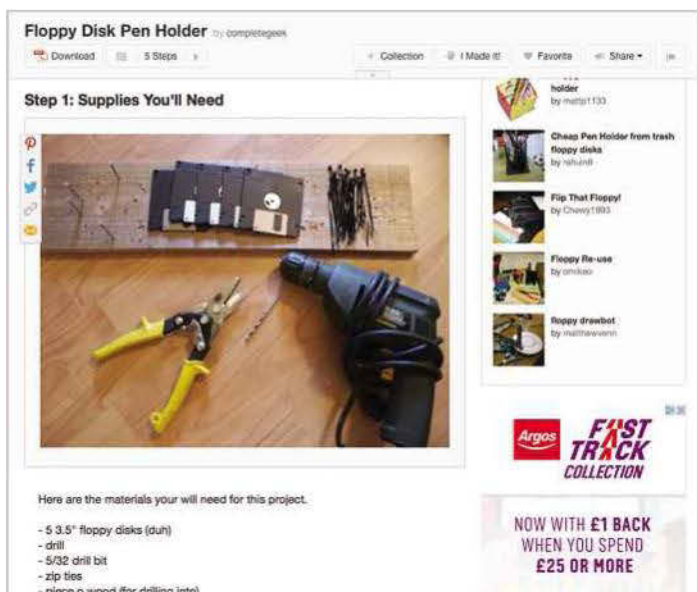
Matthew C. Applegate, aka Pixelh8, has created software called Music Tech for the Game Boy, which allows him to use the handheld as a real time synthesiser. “These wonderful devices were a huge part of our lives, and we wanted them to shine again,” he says. “The Game Boy was small and brilliantly designed, and it produces amazing sounds. It was simply us adapting our toys into a means of expression.” The Game Boy has eight inputs – up, down, left, right, select, start, B and A. Applegate mapped these to musical keys, and it plays what are called chiptunes “to shake nightclubs to their foundations.”

Of course, we can’t discuss music without mentioning the Atari ST, which was also a favourite among musicians. There are loads of hardware hacks you can perform with this machine, whether you simply want to connect it to an Amstrad CM14 monitor, give it access to IDE mass storage or provide stereo output on the pre-STE range. You can also grab a Sega Mega Drive controller and tweak it for use on this computer. A good source for these kinds of projects is www.atari-wiki.com/index.php/Hardware_hacks.

Revitalising Machines

By now you should be buoyed by the possibilities. Old tech can still give you a lot of pleasure and help you to learn more about computers as you configure them to do more than you felt they would achieve the first time around. At the very least, you should lend them some tender loving care and give them a good clean. Too many systems have yellowed over the years and look a tad grubby, but careful use of a chemical mixture called RetrObright should bring them back to life.

RetrObright needs 6% or 12% hydrogen peroxide solution, 4.9ml per 3.8l of tetraacetylenediamine and a UV light. Hydrogen peroxide was found to be effective in de-yellowing computers and consoles by the CBM Museum in Wuppertal in Germany, but the formula was devised by Dave Stevenson from Manchester. But be very, very careful. Hydrogen peroxide is hazardous and it isn’t good on plastic that is already brittle. It may also cause longer-term damage, which will counteract any attempts at preserving your computers for years to come. So wear gloves and glasses, cover up anything valuable, and be very aware of the dangers. Happy modding. [mm](#)



▲ Mods don’t need to be high-tech. Instructables shows how you can build a pen holder from floppy disks

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Death of Mozilla

David Briddock asks if open-source stalwart Mozilla is about to self-destruct



Mozilla has been around since the dawn of the web. Over the years, it's made an invaluable contribution to the open-source movement in terms of projects, products and funding support.

However, as it celebrates its 18th birthday Mozilla's future looks uncertain. It has decided to forgo its primary funding stream, terminated its high-profile smartphone initiative and now appears to be veering off in a brand new direction.

What's really going on at Mozilla?

Browser Wars

When it comes to open-source browser development, Mozilla's big battle has been with Google Chrome. Historically speaking, Mozilla Firefox has always enjoyed a strong following and a prominent position in the browser charts (see Mozilla History boxout), but over the last few years, things have changed dramatically.

Despite being a latecomer to the browser game, today it's Google Chrome that dominates, while Firefox is increasingly seen as a niche alternative. Google has successfully levered its position as supplier of the world's favourite search engine, and it has attracted and engaged developers to create a sizeable collection of Chrome extensions and apps.

To capitalise on this momentum, Google also used its vast financial resources to create the Chrome operating system and encourage manufacturers to build Chromebook laptops and Chromebox desktops. Also, Google's highly popular Chromecast TV dongle works seamlessly out of the box with the Chrome browser.

Funding Hole

However, Google's financial outlay in pursuing search engine dominance has been of immense help in funding Mozilla projects. In fact, search engine referral payments have contributed up to 90% of Mozilla's \$300 million income. This deal was struck at a



▲ Firefox OS smartphone

time when all web interaction was done with PCs and Firefox was the fast rising star of the web browser marketplace.

Yet, in 2014, Mozilla decided it needed to distance itself from Google. Consequently, it abruptly terminated this income stream. Mozilla does have other search deals, including Baidu in China and Yandex in Russia, but strangely Mozilla decided to replace Google with Yahoo as the default Firefox search engine. This is confusing to say the least. Yahoo is not only going through its own set of financial and global positioning troubles, but it's also powered by Microsoft Bing.

Chief financial officer Jim Cook seemed unfazed about filling this funding hole. After all, he knew Mozilla had big plans for its new sponsored tiles and own ad revenue streams, and then there was the Firefox OS initiative for the mobile marketplace.

Unfortunately, this bullish optimism would soon begin to fade.

Goodbye To FireFox OS

At some point in 2015, Mozilla decided it would end its experiments with the Firefox mobile operating system. Firefox OS had been unveiled in 2013. The primary targets were the developing world and late adopters, which in turn meant delivering low-cost handsets. Very low-cost handsets in fact – as little as \$25 in some cases.



Part of the plan was to increase user choice and offer far greater levels of control. To differentiate this OS from Google Android and Apple iOS, the focus was on delivering a web-first mobile platform. In other words, no native apps, only web apps.

The development community got quite excited by this news, but the same couldn't be said for consumers. Despite rock bottom pricing, sales were poor, and when a deluge of low-cost Android smartphones hit the marketplace, the battle was as good as lost. From a business perspective, Firefox OS was a failure.

In December 2015, Mozilla officially announced the end of the Firefox-powered smartphone dream. It will completely stop support and development of the operating system in May 2016, after the release of Firefox OS version 2.6. It will also stop accepting Android, desktop and tablet apps for its Marketplace, although it will continue to accept Firefox OS apps till 2017.

Rebirth

However, Mozilla isn't simply going to throw away that huge investment in time and money. In reality, Firefox OS was designed from the start as a scalable platform – an operating system that works on, say, an HD TV just as well as on a lower-end smartphone.

Mozilla's latest push is to utilise what's already been achieved and apply it to the vast Internet of Things (IoT) playground, which interconnects billions of devices in homes, retail establishments and industry. There's little doubt that IoT technology is about to change the world around us, and Mozilla wants a place at the table.

Mozilla's response is to launch its Connected Devices project (wiki.mozilla.org/Connected_Devices). This will be a genuine open-source project, with a core focus on the user experience and a set of build tools that encourage the resulting ecosystem to grow.

There are already a number of projects on the IoT shortlist, each designed to whet the appetite of the open-source community. Each project has its own web page, and it's here you'll find details on the types of community help needed. Let's have a closer look at some of these projects.

Project Link

Project Link, which was originally called FoxLink, is an intelligent personal user agent that monitors your preferences, technology interaction and daily habits. This information is used to control network-connected devices around your home in an automated manner.

In operation, Link 'discovers' devices that use the Z-wave wi-fi protocols. Users can then interact with any connected device either directly in the home or remotely via a web app. The



Interestingly, the project website (wiki.mozilla.org/Project_Link) suggests most of the code will be written using the Rust language (rust-lang.org).

Project Sensor Web

The availability of network-connected sensors has never been higher. However, most are destined for proprietary commercial projects. One example is IBM's Watson services, which assemble a vast collection of public and private data but then strictly control information access.

Project Sensor Web (wiki.mozilla.org/Sensor_Web) aims to create a network of sensors that can gather crowdsourced data, which is accessible by everyone. Take a look at the Sensor Web image to see how Mozilla visualises the data flow.

The initial proof-of-concept pilot will be a crowdsourced air quality sensor network, targeting PM2.5 fine particle pollution (goo.gl/c6XGWC).

Project Smart Home

A future smart home solution would combine modular, affordably priced hardware with easily understood, rule-based software. Flexibility is the key, as this intelligent home vision begins to take shape over the coming years.

Project Smart Home (wiki.mozilla.org/Smart_Home) is Mozilla's answer to polished, commercial-focused initiatives like Apple's Homekit or open-source DIY solutions based on platforms like the Raspberry Pi and Arduino boards.

In terms of positioning, it fits somewhere between the two. The aim is to provide something far more straightforward to deploy than a DIY solution, which still delivers the levels of openness and control that's missing from Apple's proprietary offering.

Project Vanni

One of the most innovative and interesting projects on the list is Vaani (wiki.mozilla.org/Vaani). It's an enabler package for developers and device makers who'd like to add a voice interface to their devices in a flexible and customisable way.

Pretty much everyone agrees voice is destined to become an increasingly important technology interface. The main challenge

Mozilla History

Mozilla can trace its origins right back to the earliest days of the web. Back to 1998, in fact, and the release of the Netscape browser source code. The Mozilla project was a bold and forward-thinking move to harness the creative power of thousands of programmers and generate unrivalled innovation in the browser marketplace.

And the plan worked. Within 12 months, it had attracted a large and active community, with members from all around the world. Calling themselves Mozillians (**wiki.mozilla.org/Mozillians**), they contributed new functionality, enhanced existing features, fixed bugs, increased performance and even engaged in project management and planning.

This community of passionate, highly motivated individuals was far larger than any single company and wielded considerable power. Web browser technology and development tools saw huge improvements almost immediately, and it wasn't long before a number of related projects began to take shape.

The first major stable 1.0 version of Mozilla appeared in 2002. It came as part of a software suite that also included an email client and various other applications. Yet initial take-up was slow, with Microsoft's Internet Explorer still accounting for over 90% of the web surfing community.

Later the same year, something called Phoenix was released by the Mozilla community. It was touted as delivering the best possible browsing experience for both web newbies and tech savvy users. Phoenix was later renamed to Firefox.

In 2003, the Mozilla project created an independent non-profit organisation called the Mozilla Foundation. Financial support came from individual donors and a variety of companies. The Mozilla Foundation's mission was to promote openness, innovation and opportunity on the internet, and software like Firefox and the Thunderbird email client would lead the charge.

Released in 2004 Firefox 1.0 was an immediate success. Within a year, it had been downloaded over 100 million times. Regular updates ensured it would continue to set new records for some time to come. More importantly the popularity of Firefox clearly showed how important choice was to users in the face of proprietary browsers from Microsoft and Apple.

In fact, without Mozilla, the web browsers might be the most expensive and closed pieces of software today.





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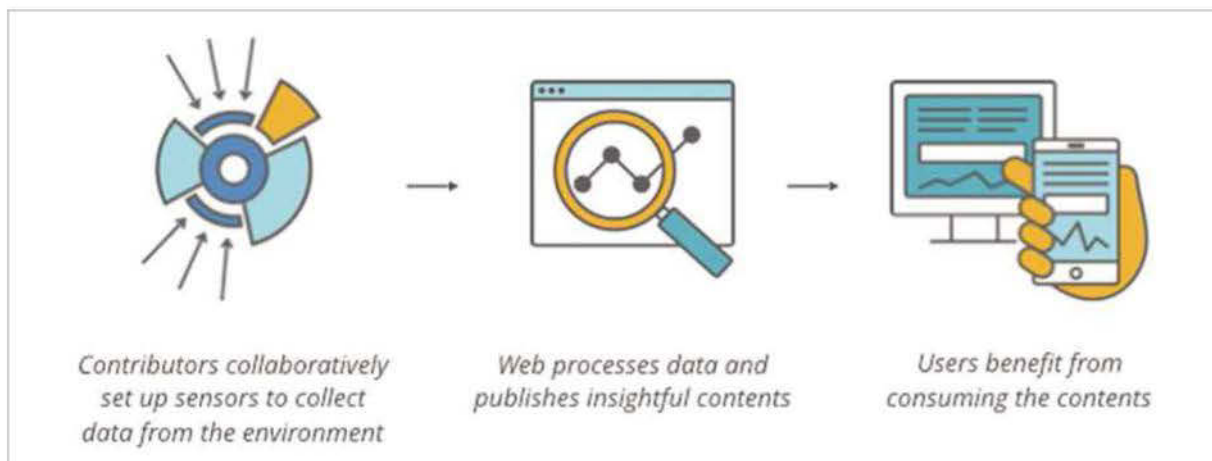
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for the Vanni team is to create something that has its own distinct identity compared with Google Now, Apple Siri and Microsoft Cortana.

An obvious initial target is to integrate Vaani with the Smart Home project, but it's equally applicable to a range of other IoT applications, and today, at least, we don't have an open and scalable voice interface solution.

Project SmartTV

This project is the most straightforward to explain. In a nutshell, it takes the existing Firefox OS 2.6 development and applies it to the HD television market.

Even so, it won't be plain sailing. Many of Mozilla's other projects rely mostly on the open-source community for their success, but this one is heavily reliant on TV manufacturers signing up to a Firefox OS installation. Whether they really want to be associated with this open-source project is unclear.

MozVR

It seems Mozilla also wants a piece of the fast-moving virtual reality (VR) scene. The website points to iOS, Android and Oculus Rift activity streams (mozvr.com). This means Mozilla aims to target both smartphones (say, with the Google Cardboard headset) and PCs equipped with high-performance graphics cards.

VR is far removed from Mozilla's web technology roots, and once again it comes up against strong competition, so why bother? Is it just to keep the Mozilla name in the news? Or maybe attract new developers into the Mozilla family, who might then get involved with other projects?

Bold Or Reckless?

No organisation can afford to rest on its laurels in the technology industry, and despite sterling work over the past 18 years, Mozilla is no exception.

The IoT arena certainly has plenty of potential for innovation and revenue generation. As Ari Jaaksi, Connected Devices senior vice president, said in a blog post, "The Internet of Things is changing the world around us, with new use cases, experiences and technologies emerging every day."

Even so, there's plenty of reasons for skepticism. Firstly, Mozilla is late to the IoT party. A quick look at the Project Smart Home wiki page clearly illustrates its embryonic status. There's an awful lot of ground to make up and a great deal of work to be done in motivating the open-source developer community.

Another problem is that it's rather too close to the failed Firefox OS scenario for comfort. The plan is to reuse a considerable

slice of this work in the IoT arena. Yet, once again, it will confront technology from Google and Apple, plus other strong competitors like IBM.

Worst of all, it could dilute the activities and developer community focus around the Firefox web browser and tools. This is clearly still Mozilla's strongest area, so is it worth putting this core work under pressure?

The End?

Let's be clear about something. We should all congratulate Mozilla and its open development community for battling against the technology industry giants. The open-source movement might not exist at all without Mozilla. Competition in the technology world provides choice, spurs innovation and helps to keep everyone honest.

Even so, Mozilla does give the impression of an organisation in disarray, scrabbling around for ideas and willing to take a punt on the latest buzz. It's not exactly the end of Mozilla just yet, but the warning signs are there.

Amid all the chaos, Mozilla has tried to maintain progress with its core open web technology. It cannot afford to lose any more ground or squander its hard won reputation. The new add blocker sits well with its stance on privacy, user tracking and cookies, and yet there's a rumour it's looking for an alternative home for its Thunderbird email and chat client.

Will the new IoT direction kickstart a revival for Mozilla? Only time will tell, but to survive Mozilla must maintain the support of its dedicated and passionate community of developers and volunteers. They need to be excited about the future and driven to build open software alternatives.

If Mozilla does disappear, that only leaves three web browser players: Chrome, IE/Edge and Safari. More importantly, out of these, only Chrome would be cross-platform, and all would be free to pursue their own browser agendas, knowing consumers can't switch to a competitive, truly open alternative.

Would you miss Mozilla? Do you prefer Firefox over Chrome? Write to letters@micromart.com and tell us what you think. **mm**

Get Involved

If you'd like to help Mozilla with its IoT vision, there are a number of ways you can get involved. Software developers are always in demand, but testing, documentation, language translation and educational roles are just as important too.

The best place to start is the Connected Devices participation page (wiki.mozilla.org/Connected_Devices/Participation), where you can discover which project, or projects, interest you most.



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Has Amazon Cleaned Up Its Act?



Avoiding tax, mistreating workers, pricing competitors out of the market... Amazon's been criticised for a lot over the last few years. Sarah Dobbs checks in to see if things are getting better

Remember when Amazon was just a site for buying books more cheaply than you could in 'real world' bookshops? Now it seems to have taken over almost every aspect of commerce – it sells everything you could ever want, with next day delivery and a super slick checkout that almost completely removes the pain of handing over your money. It's got its fingers in plenty of other pies too, from its own publishing platform, electronics, film studio, and so, so much more.

Inevitably, when a company gets that big and that successful, it's going to come under fire for something or other, and in Amazon's case, there's been a lot to criticise. From tax avoidance to scandals over working conditions in its warehouses, over the past few years it seems like there have been plenty of reasons to dislike the mega-corporation. Yet, many of us still probably use it as our primary shopping resource, certainly for media, and Amazon doesn't appear to be in any danger of going out of business.

So, now that the dust has settled on revelations like Amazon only paying 1% of the tax it should have done back in 2011, it's time to take another look at the company, and see if it's managed to turn things around. Is Amazon now as cuddly as it would like you to think?

Tax Woes

The tax thing is one of the biggest reasons people turned against Amazon. Back at Christmas 2012, John Lewis was one of several big British companies to speak out against Jeff Bezos and co, asking people to consider supporting businesses who actually contributed to the country via paying tax. Considering the economic climate, swerving a potential £200 million in tax (in a single year) meant Amazon looked a bit like a cartoonish villain,

diving into a swimming pool full of its cash while the government made cuts to public services left, right, and centre.

Since then, things have changed a bit. Last year, Amazon agreed to change its questionable corporate structure so that, rather than booking transactions in Luxembourg, where taxes are lower, it set up local branches in the various European countries where it operates. That means UK sales can be taxed in the UK. Good news, right?

Well, sort of. HMRC won't yet have seen much of Amazon's money; last year, for example, despite £5.3 billion in sales in the UK, Amazon paid just £11.9 million in tax, because sales were still being recorded in Luxembourg. Amazon has also argued that it doesn't make anywhere near as much money as people think, because sales aren't the same as profits, and its overheads mean that its profit margins are relatively slim. Still, from now on Amazon will at least be paying more tax in the UK than it has to date, so that probably counts for something.

Worker Welfare

2011 also saw Amazon scrutinised for its treatment of staff – specifically, the staff who work in its many warehouses around the world, picking items for delivery to customers. According to some workers, conditions in the warehouses were becoming unbearable, particularly in some parts of the US during the summer, where heatwaves made it difficult to physically tolerate the work. Further indignities included temporary contracts that could be terminated at any time, for any reason – including taking more than three sick days in three months, despite the long hours and difficult conditions. Several journalists went undercover in Amazon warehouses back in 2013 to investigate, and found things were, indeed, pretty grim.

HAS AMAZON CLEANED UP ITS ACT?



So, again, have they improved? Not according to the GMB trade union, who reported last year that staff working in Amazon's UK 'fulfilment centres' had developed both physical and mental illnesses as a result of the working conditions. The problem comes from Amazon's data driven focus on efficiency at all costs. Workers are issued with handheld devices that tell them where items are stored in the warehouses, and which track them as they retrieve them. Built-in timers countdown the seconds allocated for the workers to grab each item on their list – workers are expected to pick approximately 1,000 items per 10-hour shift, and if they miss enough of the countdowns, they'll miss their productivity targets. There's no room for being a bit under the weather, and even toilet breaks are timed.

It all sounds pretty horrendous, even before you factor in the reports that in American warehouses, there are screens showing silhouettes of former employees, stamped over with the reason for their terminations. While it's understandable that Amazon wants to discourage staff from stealing, those kinds of Orwellian tactics seem a bit over the top, especially since workers are also made to go through mandatory searches before leaving the workplace.

On top of the stress of it all, it's not a particularly well paid job, and just last month workers in German Amazon warehouses went

on strike to try to demand a fairer deal – and not for the first time either. On balance, it doesn't sound like working conditions have improved massively over the years.

A Glimmer Of Hope

Ready for some better news? Amazon can pride itself on a commitment to gender and racial equality. A report published by the retailer last month showed that in a review of pay across the organisation, women made \$0.99 for every \$1 made by a man in the same role, while non-white workers made \$1.01 to every \$1 made by white staff doing the same jobs. That's pretty commendable.

In the US, Amazon also qualifies for a brownie point or two for its Amazon Smile program. Through the program, 0.5% of any money shoppers spend on Amazon is donated to charity, at no extra cost to the shopper. It's not a massive percentage, and there's been some criticism of the scheme for that reason, but, well, it's certainly better than nothing.

Finally, Amazon has recently announced that it's going to be opening a fulfilment centre in Manchester, creating approximately 1,000 new jobs over the next couple of years. Unfortunately those might not seem like highly desirable jobs, all things considered. However, local MPs, like Labour's Mike Kane, seem to be happy about it and the opportunities it'll bring for their constituents. So, again, it can't be all bad.

General Dystopian Vibes

Maybe the real problem with Amazon is that is sometimes just gives you the creeps. Some of its plans for the future, for example, seem ripped from the plot of a dystopian sci-fi movie, and sometimes it just makes bad decisions.

Amazon's ambitious plans for a drone delivery system, for example, might be practical, but it all sounds terrifying. Dubbed Amazon Prime Air, the new system could mean customers would receive their Amazon deliveries faster than ever before – in some cases, within 30 minutes of ordering, according to Amazon's Paul Misener. The specially designed drones would be able to sense and avoid obstacles in their paths, and would fly at between 200- and 400ft above ground level, low enough to





avoid colliding with aeroplanes or helicopters. It should all sound really exciting, but instead there's something faintly sinister about it. Maybe it's just that there have been too many science fiction movies featuring evil robots?

A recent patent filed by Amazon reveals how the drones will warn people of their presence: they'll use their propellers to create a noise that sounds like a voice shouting "watch out!" or maybe spell out messages using lights built into their propeller blades. Fancy getting your shopping delivered by one of those?

Then there's the stuff that's actually happening now, and shouldn't be. Amazon sells all sorts of products through its site, which is why it's so huge, but it also means that sometimes, things get shipped to people they shouldn't be. A teenager from Aberdeen who murdered a fellow pupil at his school bought the murder weapon, an age-restricted knife, from Amazon – getting round the law by sticking a note to his front door and having the parcel left outside, rather than accepting the delivery in person. To prove it wasn't a one-off, *The Guardian* tried a similar trick, ordering restricted knives and having them delivered to a family home, then not opening the door to the Amazon Logistics delivery person when they arrived.

Other restricted items, like illegal stun guns and pepper sprays, were also found being sold by third parties through Amazon's site. Amazon wasn't selling them itself, from its own warehouses, but facilitating the sales; obviously there are millions of things sold from third party sellers every day, so Amazon can't realistically check every single listing individually, but it does have to bear some responsibility for these kinds of problems.

Does It Matter?

The thing is, Amazon now seems to be too big, and too convenient, for any of its faults to *really* matter. The proof? Well, the US-based Reputation Institute compiles an annual list of the top 10 most reputable companies, and for the past three years running, Amazon has sat right on top of that list. It's hard to argue with the fact that it genuinely makes it easier to buy things – you can even set up subscriptions for things like household essentials, so that you know you'll never run out of toothpaste or toilet roll. What's more, it's almost always cheaper than going out to buy it from a physical shop, which is the thing that counts for most people.

Want To Boycott Amazon? You Probably Can't

Here's the real kicker when it comes to Amazon: even if you wanted to avoid using its products entirely, you probably can't.

You could avoid using www.amazon.co.uk to buy things, of course. That's relatively easy, although actually if you want a specific book, CD or DVD your choice of alternative outlets is fairly limited, especially now so many bookshops and high street music and movie shops have closed down. Even Play.com doesn't really exist any more. There are alternatives, they just require a bit more time and effort (and money) to track down.

You can also avoid using Amazon's online movie and TV streaming services by choosing to use an alternative like Netflix, though there are some Amazon exclusives you'll have to live without.

If you want to read ebooks, you'll find your Amazon alternatives are fairly limited. Even worse, if you like audio books, you'll have to avoid Audible, which is owned by Amazon. Bad news, too, for comics fans, since ComiXology is owned by Amazon, and so, too, is GoodReads – so if you're into logging the books you read, you'll need to find another way to do it.

Amazon is also behind lots of other websites. You might not know it, but lots of sites use Amazon's Web Services to power their sites and applications. When it comes to trying to avoid a company as omnipresent as Amazon, resistance is all but futile.

Amazon is a huge company right now, and one that only seems set to grow over the next few years – in terms of profits, number of warehouses, and influence. There's a well-known quote from a comic book character that seems appropriate here, though: with great power comes great responsibility. A company the size of Amazon has responsibilities, not just to its shareholders but to its workers, its customers, and ultimately the countries it operates in. And at the moment, unfortunately, it doesn't seem like the company is fulfilling those responsibilities. [mm](#)

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Top 10 Calendar Tips

The Windows 10 Calendar has steadily improved since it was first seen and is now a useful tool. Roland Waddilove list his top 10 tips

1 Enable The Live Tile

This is the simplest tip of all, but it is one of the most useful. The Windows 10 Start menu contains tiles for starting apps, but they can also show live content. Right click the Calendar tile on the Start menu and select More, Turn live tile on. Then right click it and select Resize, Large so there is room to display events from your Calendar. It shows today's appointments and it means you can see what is coming up without even opening the Calendar app.

2 Add A Holiday Calendar

It is useful (and easy) to add public holidays to the calendar: click More Calendars at the bottom of the left panel and then select the UK holiday calendar, or another country's calendar if you prefer. Depending on how big the window is, you might have to scroll down the left panel to see the holiday calendars section. There is a tick box to show/hide each you add. You could add several countries and then show the one you want when you need to check on holidays.

3 See A Weather Forecast

A great feature of Calendar is the mini weather forecast today and on each of the next five days. Select Week or Month views to see the forecast. There is a symbol showing sun, cloud, rain and so on, and the maximum and minimum temperatures. The weather symbol in the calendar is clickable and it opens a web browser to show a details weather forecast on msn.com.

4 Change The Colours

There are several customisation options for Calendar and you can completely change the way it looks. Right click a calendar in the left panel and a grid with nine coloured tiles is displayed. Click a colour and events for that calendar are displayed in that colour. This enables you to distinguish between events, such as those in your calendar, in a holiday calendar, Cortana reminders, and any other calendars you might have.

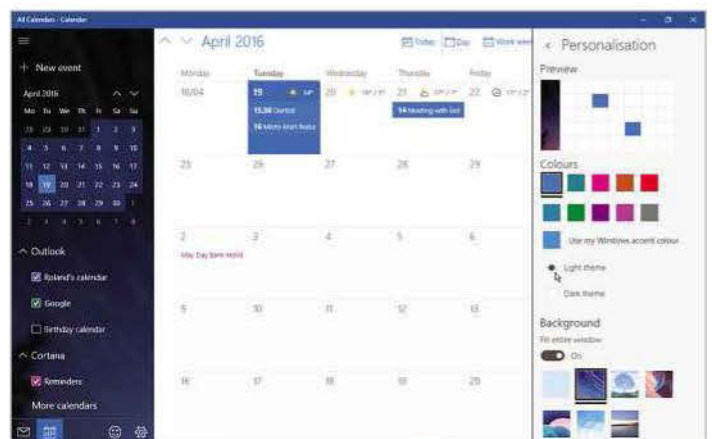
There are many more customisation options in the settings. Click the gear icon at the bottom of the left panel to open the settings panel and select Personalisation. At the top you can choose the calendar colour and in the middle is a choice of light or dark theme. At the bottom is Background and this enables you to choose from a selection of background images. There is also a browse button that enables you to choose your own background, such as a photo on the disk drive. The image only seems to display in the left panel and the calendar itself is a solid white or dark grey depending on the theme.

5 Add Extra Accounts

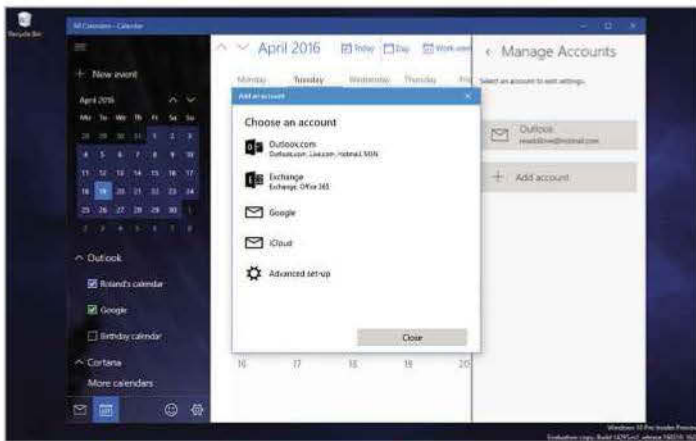
If you have a calendar elsewhere, such as another Outlook.com account or Google Calendar, the Windows Calendar app can read it and show the events. A different colour can be set for each one using the previous tip, so you can tell which calendar an event is on just by looking at it.



▲ Set the tile size to large and make the tile live to show your appointments



▲ Choose light or dark theme, select the colours and pick a background



▲ If you have calendars elsewhere, such as Google, add them to Windows 10 Calendar

To add an account, click the gear icon and then select Manage Accounts. Click the plus button to add an account and there is a choice of Outlook, Exchange and Office 365, Google, iCloud (used with Apple Macs), and Advanced set up. The first four are easy because Calendar knows the right settings to use and adding Google Calendar is really easy, but with the last you need to know your POP or IMAP login details, such as user name, password, incoming and outgoing servers, and so on.

6 Customise Calendar Settings

What day does the week start with? That's not as stupid as it sounds and if you use Calendar for work it is often useful to set the first day as Monday, which is better for organising work appointments and events.

Click the gear icon to open the settings panel and select Calendar settings. At the top you can set the day the week starts on. There are also options to set the work week, so if you work four days for example, you can set them here. This is useful because in the main Calendar view is a Work Week view that shows just the days you are working this week and the events and appointments that are scheduled.

A bit further down the settings is an option to set your work hours. This sets a slightly different background colour to the work and non-work hours.

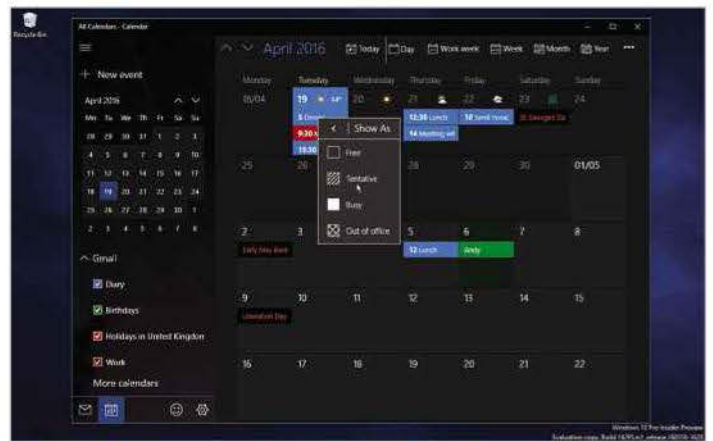
7 Print Your Schedule

The day, week, work, and month views can all be printed, but the year view cannot. Select a view and then click the three dots in the top right corner of Calendar. Click Print and the print preview window appears. You can print to a physical printer or to a PDF file. A PDF probably isn't that useful, but printing your work day or week is useful if you are going to be out without your computer.

8 Invite People To Meetings

This is a brilliant feature of Calendar and you can see who is coming to meetings and events and who can't make it. Click in the calendar to create a new event and enter the event name, location and time. Then click the More Details button. A new event form appears and on the right is a box, into which you can enter email addresses. It is linked to the People app with your contacts, so you can just start typing a name and then click one of the suggestions.

When the event is saved, emails are sent to the people on the list and they see a description of the event and Yes, Maybe and No buttons. When those are clicked, the Calendar app records the fact and so you can see who has accepted or declined the invitation.



▲ Set your time for an event as busy, free, tentative or out of the office

9 Organise Your Time

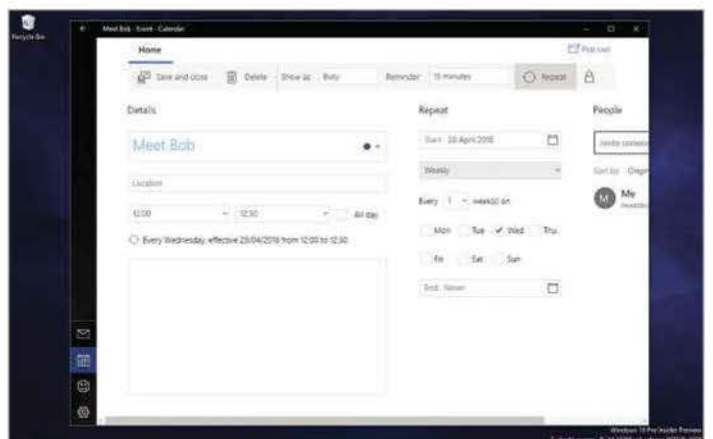
Some events last all day or even longer, such as a holiday or a trip. For those, tick the all day option. For others you can choose to set the time of the event to one of four states. Right click an event in the calendar and click Show As. There are options to set the time as Free, Tentative, Busy or Out of Office.

The option you choose affects how the event is displayed, and there are different patterns for each one. This decision will also affect warnings too. For example, if you set an event as busy and try to schedule another event at the same time, you'll be told that it clashes and you then choose another time. Some events, such as working on a project all day, could be set as free time, because you can always find half an hour during the day to have a meeting with someone.

10 Set Recurring Events

Setting up recurring events is a great time saver and if you have work meetings every Monday at 10am, you can create one event and set it to recur automatically every Monday. It is handy for personal events too, such as if you see a friend every Thursday evening and so on.

Click in the calendar and enter the event name. Clear the All day box and enter the time. Click the More details button and in the new event form, click the Repeat button in the top right corner. New options appear and events can be scheduled to occur every day, week, month and year. There is an option to set an end date or let it run forever. **mm**



▲ Create recurring events that automatically appear in the calendar on a schedule defined by you

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Top 5

Things That Were Before Their Time

Proof that sometimes being first really is worst

1 OQO UMPCs

Although it wasn't the first company to produce ultra mobile PCs (UMPCs), OQO's devices were considered some of the best around. Like other UMPCs, OQO products were tiny computers that ran a full version of Windows and came with a full qwerty keyboard. Today, of course, even budget tablets run Windows 10, but at the time, UMPCs seemed truly futuristic. Unfortunately, thanks to the high cost of such devices, as well as other problems, such as poor battery life, OQO eventually shut its doors in 2009. Today, smartphones, tablet and hybrid devices fill the niche that UMPCs were trying to, but OQO just got there a bit too early.

2 Microsoft Tablet

In 2001, Microsoft came up with a list of specifications for tablet computers, which hardware manufacturers could adhere to, and it included running a copy of Windows XP Tablet Edition. Looking at the success of the iPad and other tablets today, you have to give Microsoft credit for spotting the potential here. Unfortunately, over-reliance on stylus use, as well as high prices and poor performance mean it was never able to really take off. It wouldn't be until 2010, on the release of the first iPad, that tablet devices would be taken seriously again.

3 Virtual Boy

Despite generally not being very good, virtual reality in the early 90s managed to ignite the public's imagination. VR was everywhere, from Virtuality arcade machines to movies like *The Lawnmower Man*. No wonder Nintendo thought it would be a good idea to release a virtual reality console. It wasn't.

The fact is that the technology needed to create a decent VR experience simply wasn't available - not at consumer prices anyway. What Nintendo produced was weird red graphics, a console that needed its own stand and device that gave its users headaches.

4 Apple Newton

Looking at Apple's success today with mobile devices, it's hard to believe it ever got it so wrong. But the Apple Newton was a device that was big on ideas but low on decent execution.

It might look basic today, but at the time, this PDA was actually fairly high-tech, and one its biggest selling points was

handwriting recognition. Using the stylus, users were supposed to be able to write on the screen, whereupon the Newton would translate their scribbles to digital text. Unfortunately, it just wasn't accurate enough. Subsequent updates improved things, but it was never enough to make the device a success.

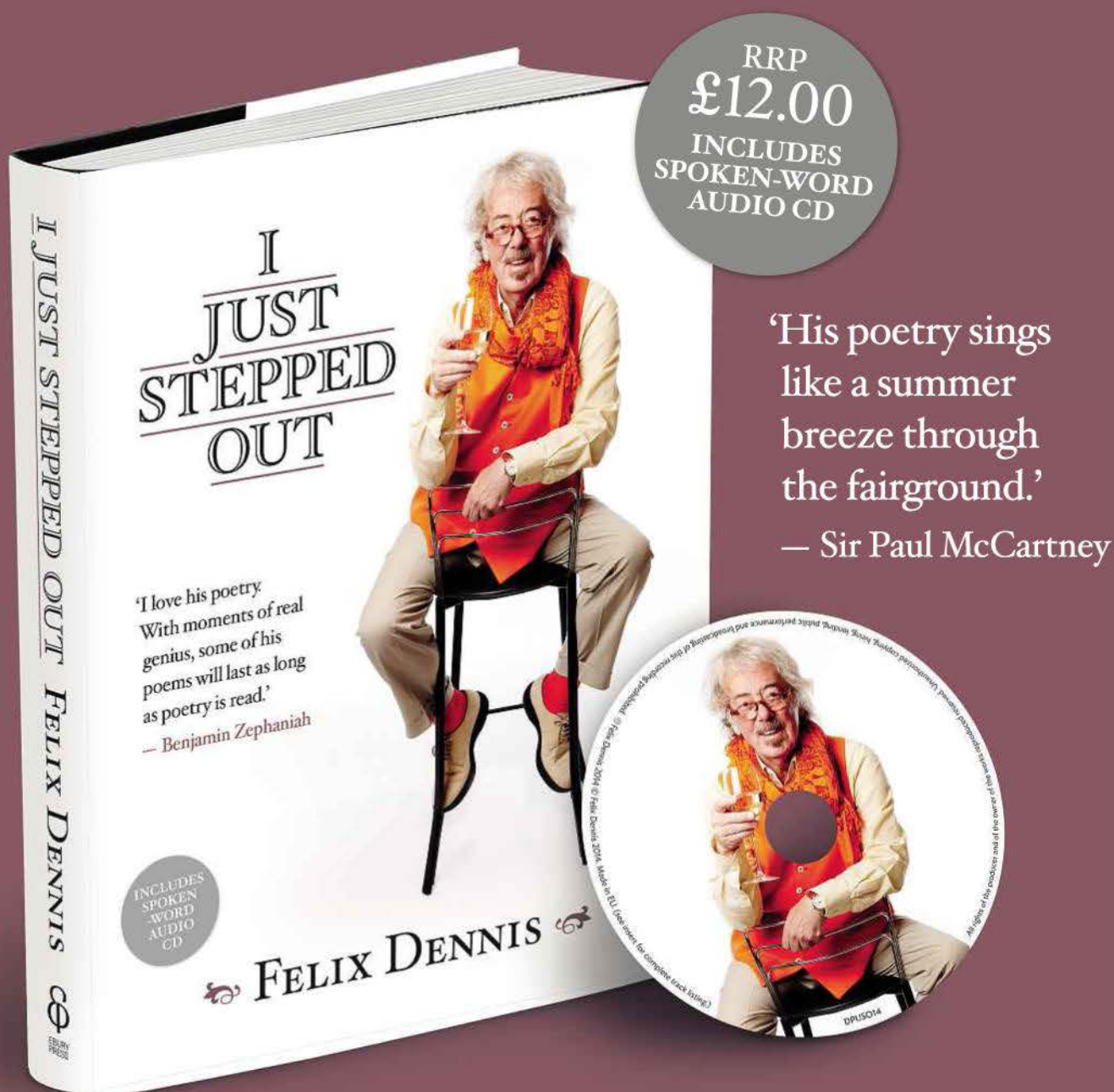
5 Dreamcast

Online gaming is big business these days, whether you're talking Windows PCs or games consoles. In the late 90s, though, that wasn't the case, especially since most people were using dial-up internet. That didn't deter Sega, however, and when it put together what was to be its last games console ever, it included a 33.6Kbps modem (upgraded to 56Kbps in some later versions). The Dreamcast, though, in spite of its online connectivity and innovative games, couldn't do enough to appeal to a public eagerly awaiting the PlayStation 2. Sega did a lot right with the Dreamcast, but in the end it was just too far ahead of its time.



▲ An OQO UMPC: great for those with big wallets and tiny fingers

I JUST STEPPED OUT



A startlingly honest and intense collection, *I JUST STEPPED OUT* is a kind of 'last will and testament' in verse. Written by Felix Dennis after his diagnosis with terminal cancer, these poems chart his physical, emotional and psychological journey.

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For more information on Felix Dennis go to: www.felixdennis.com

Component Watch

There are a couple of good reasons to want a good quality mic for your PC. So, should you be on the lookout, here are some of our favourites

If you're thinking about putting together a podcast or other audio project using just your PC, you need to get a microphone – and there are tonnes available, from across the price spectrum. We've picked the best at a few common price points so that you don't have to search for yourself!

Deal 1: Trust Starzz Microphone

RRP: £15 / Deal Price: £9

This low-price desk mic comes with an extra-long 250cm cable and a mini-tripod. While it has to be said that, certainly in terms of sensitivity, it isn't brilliant (it works best as a handheld rather than a desk mic) you can't argue with a price that low, if you want to get recording at next-to-no expense. A 3.5mm jack and an on-off switch makes it convenient and compatible with a huge range of devices. It's an ideal entry-level piece of hardware – although if you've already got a mic on your phone/tablet/laptop, we'd have to say it's probably not much better than that!

Where to get it: CPC (bit.ly/1rop2eA)



Deal 2: Foxnovo SF-920

RRP: £16 / Deal Price: £14

The Foxnovo SF-920 is a professionally-balanced condenser mic with noise-reduction feature, built-in hardware on/off switch, a two metre lead and a 3.5mm jack connection. Shaped and styled specifically for desktop use (and with a desk tripod included) it's an ideal first choice for podcasting and voice chat, especially because it'll eliminate some of the background hum usually created by PC fans automatically! At just an extra fiver, it's a huge step up in both style and substance compared to the Starzz microphone, for not much more money at all. So, unless you really are working to tightest of budgets, stump up the extra fiver.

Where to get it: Amazon (amzn.to/1f8T8LZ)



Deal 3: Snowball iCE HD Audio USB Microphone

RRP: £70 / Deal Price: £50

This high-quality desk mic allows you to record audio on any USB-compatible system, whether for chat or more professional reasons. It's sensitive enough for even quiet voices, but has a large enough dynamic range to capture bands and instruments too. There are no drivers to install and it comes with an adjustable desktop stand and the USB cables you need to get started. Worth the money, especially at a discount!

Where to get it: Maplin (bit.ly/26gx0eo)



Deal 4: Zoom iQ5

RRP: £100 / Deal Price: £45

If you prefer to do your recording on a smartphone, the Zoom iQ5 might be a better option for you than the device's internal mic. This high-quality stereo condenser mic is ideal for recording music but also small enough to fit into your pocket. Its orientation works both vertically and horizontally and you can use the associated app to adjust the stereo performance in real time. A fantastic accessory for any compatible smartphone, and you can pick up the iPhone version for more than half off!

Where to get it: Gear4Music (bit.ly/1WfiZEf)



Deal 5: Editors Keys SL150

RRP: £115 / Deal Price: £75

If you want to record high-quality vocals, instruments and podcasts, you need a microphone like this: dual 34mm shock-mounted diaphragms eliminate all unwanted noise, fully digital connection ensures no interference, and a 5 year warranty means if anything goes wrong, you can always get a replacement. Driverless and compatible with all USB-enabled systems, it's an expensive microphone, but it's also the last you'll ever need.

Where to get it: Inta-Audio (bit.ly/22Q1N8s)





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EU Competition Commissioner Goes After Google

Wozniak Unimpressed With Wearables

Singles out Apple Watch. Shocker

It would seem that not everyone is a fan of wearable technology. Steve 'The Woz' Wozniak just doesn't see the point, explaining to a captive audience at a Future Transport Summit down under that wearables are not a "compelling purchase".

Woz isn't convinced by the power that wearables offer consumers – complaining that his own Apple Watch used up too much battery life – and is also reportedly frustrated by the fact that they are dependent on smartphones to connect with the digital world. If you're in any doubt as to how he really feels, he described Apple's device "an expense that bought me a few extra niceties in my life" and compared it to having a Bluetooth earpiece connected to a phone. In a final damning comment, Woz reportedly said: "People say that if you put the name

Apple on it, people will line up to buy it... I think it needs a little more than these watches have."

While it's unlikely that his comments will have a huge impact on Apple Watch's popularity, they're certainly interesting.



Phone deals now under scrutiny

The European Competition Commissioner has Google in her sights over claims that the company has been favouring its own apps on Android smartphones. The problem reportedly centres around the demands from Google that any phone manufacturer using the Android operating system is required to preload a set of Google apps onto the mobile device instead of having a free say in what apps and services they choose to install from the off.

This new, potentially serious, challenge follows a previous complaint that Google has favoured its own shopping service in search results. While in the US, the Supreme Court has given the firm a boost by refusing an appeal from the Authors Guild in a legal case claiming that copyright laws were breached as books had been scanned into a searchable database without permission. Google has claimed that its database constitutes 'fair use' and the Court's support of that view is now final.



As someone with more than a passing interest in PC gaming, I'm excited by the prospect of virtual reality systems like the HTC Vive and the Oculus Rift. And then I look at how much raw computing power I'd need to run one.

The headsets themselves are expensive enough as it is, but that's to be expected, because they're a new technology. But on top of that, you also need to factor in a high-end PC with an extremely fast graphics card. That can easily cost you several hundred pounds.

For a while, then, like a lot of you, I'll be priced out of buying a VR device for quite some time. That's a shame, but then I look at what people are doing to modify old computers, and it reminds me that you don't always need to have the latest gadgets to enjoy technology.

In fact, with the right mix of enthusiasm and perseverance, old computers can be every bit as interesting as the new stuff – if not more so.

Do you have any old systems you still use or that you've modified? Drop us a line at letters@micromart.co.uk and tell us all about it.

Anthony

Editor

Flash! AH-AH! Now It's Hardware- Encrypted

Erm, maybe that doesn't work as well as we thought...

The good folks of Kingston Digital are a busy lot. The memory masters have released yet another couple of flash drives, these ones aimed at high-end users. The management-ready, 256-bit AES hardware-encrypted DataTraveler 4000G2 with Management and DataTraveler Vault Privacy 3.0 with Management promise to protect data at the very highest level across a mobile workforce. The key security feature here is that these can be managed with SafeConsole management tools while the drives lock down and reformat after ten failed access attempts. Additionally, they function in read-only access mode to avoid any possible malware risks.

The management tools side of things might appeal if you own a small company, but there are also standard versions of these drives for general use. If you're the security-conscious type and these drives sound like your kind of thing, head to www.kingston.com.



Meanwhile... On The Internet...

If it was ever in any doubt, the 1000 pages of documents released by Privacy International sought to shine a spotlight on the sheer breadth and depth of the insight the UK's spy agencies get into our lives through bulk data collection (tinyurl.com/MMnet11a). The trove of information (tinyurl.com/MMnet11b) showed up how the collection of so-called Bulk Personal Datasets means that authorities can access and hold large amounts of information on people who are not suspected of any crime.

Worryingly, while the information is being used for reasons well beyond searching for terrorists and major league crims (tinyurl.com/MMnet11c) it seems that there is little in the way of safeguards to oversee misuse of this data by those with access to it beyond sternly worded warnings in guidelines. These guidelines, however, don't seem to lead to disciplinary action very often – *Ars Technica* point out that between 2014 and 2016 only five people had been subject to disciplinary proceedings over misuse of the information, while many cases had failed to get as far as a disciplinary hearing due to 'non compliance issues'.

Of course, the scary thing in all this is that such bulk data trawling would be normalised under the new Investigatory Powers Bill, of which we've talked *ad infinitum* lately. What's more, they way Privacy International's legal challenge to Dataset use was held in secret, with none of its legal representatives present, gives an insight into what we can expect should anyone want to challenge the IP Bills powers and intelligence practices in the future.

While back in these pages we covered the methods used by the FBI to reveal the users of an especially distasteful Dark Web site known as Playpen (tinyurl.com/MMnet11d). Specifically, how the Bureau had taken the questionable decision to run the site for two weeks from its own servers in order to uncloak the identities of users using a Network Investigative Technique (*aka* a drive-by malware attack: tinyurl.com/MMnet11e) to expose real world IP addresses of Tor browser users.

However, in a move that will add fuel to the fires of those who questioned the reasoning behind keeping the site going for any amount of time after it had control of it, a US court has ruled that the FBI tactics amounted to an unlawful search. Even more frustratingly, the evidence has been thrown out on a technicality rather than a point of law or policy: apparently the Magistrate that approved use of the NIT did not have jurisdiction to do so (tinyurl.com/MMnet11f).

This oversight on the Feds' part, then, could mean that not only did the site continue to distribute it's horrible wares for two weeks when it could have been offline, it may also mean that absolutely no convictions will arise from it. Which is about as close to a lose-lose situation as you could imagine.

If you've been following the US Election over recent months it would have been easy to get distracted by the sideshow presided over by Donald Trump, or the increasingly bitter war of words between Hillary Clinton and Bernie Sanders. However, thanks to the laser-guided focus of the denizens of Twitter (tinyurl.com/MMnet11g) and Facebook (tinyurl.com/MMnet11h), certain sections of the internet have been focused on the *really* big question: is Republican candidate Ted Cruz the infamous Zodiac Killer (tinyurl.com/MMnet11i)?

The TLDR (tinyurl.com/MMnet11j) answer to that is, of course, 'no'. Despite what your eyes may be telling you, and despite the chances that he could be Oswald Cobblepot's not-so-cool uncle (tinyurl.com/MMnet11k), Ted Cruz is only 45, making him less than a twinkle in Rafael Cruz's bright Cuban eyes (tinyurl.com/MMnet11l) when the Zodiac was conducting his nasty business in the late 60s (tinyurl.com/MMnet11m). The facts, however, should never be allowed to get in the way of a good meme (and they very rarely do, it has to be said: tinyurl.com/MMnet11n).

So why do we mention a meme that began in 2013 now? Well, according to Tumblr blog The Infinite Box (tinyurl.com/MMnet11o), Ted Cruz's staff may have been forced to act upon the joke; specifically, by asking Google to remove autocomplete entries related to search queries beginning 'Is Ted Cruz...' One can see why they would want that, we suppose... but, y'know, makes you think. Right (tinyurl.com/MMnet11p)?

it's not the first time Google has been accused of tinkering when it comes to it's autocomplete system (tinyurl.com/MMnet11q), but we're sure there's nothing to see here. Move along...

While the recent F8 conference gave an insight into the future of Facebook – including its plan to expand its use of augmented reality and engage users with bots in Messenger (tinyurl.com/MMnet11r) – a video has also emerged that affords a fascinating, and slightly cringeworthy, look at the culture of the nascent thefacebook.com team of 2005 (tinyurl.com/MMnet11s). The footage shows El Zuckertino (as we like to imagine he was called by his bros) lounging in a distinctly non-corporate environment, holding a red solo cup (www.solocup.com) – an appendage much beloved of rock icon, Dave Grohl (tinyurl.com/MMnet11t) – and showing a distinct lack of ambition for the scope of what his social network could achieve.

Was it all for show? When did the plan for connecting the world form? The answer to those questions are certainly not to be found in this footage. It does, however, serve to show how much can change in a decade, and give a little hope to scruffy, beer loving brainiacs everywhere. Not that that description resembles anyone we know...

.AVWhy?

Videos For Your Eyes...
Not Necessarily For Your Brain

While the new Wii U game from Nintendo's legendary Shigeru Miyamoto (tinyurl.com/MMnet11u), *Star Fox Zero*, has been receiving mixed reviews in the press (tinyurl.com/MMnet11v), it's still getting a high profile release and generating a lot of interest among gamers who remember the original *Starwing* (its European name), and the later *Lylat Wars* fondly. Accordingly, the run-up to the release last, we got to see a natty 15 minute anime prequel to the new game, which sets up the adventure to be played out on Wii U's over the coming weeks (youtu.be/wA2-0nTxaGg).



Caption Competition



"Users react to the price of Amazon's new e-reader"

Another bumper crop of responses for this image from issue 1409. Enjoy our sample of faves, why don't you?

- **Ondrive:** "AMC's competitors get wind of its 'text-friendly screenings for millennials' plan."
- **Lee Washington:** "Woman wearing the world's biggest jumper smiles smugly as the ice cold cinema air conditioning gets turned on."
- **Ondrive:** "And, then... and then... he said 'we want to charge people \$50 to watch new movies at home!'"
- **BullStuff:** "Cinema audience reaction as Sylvester Stallone shuffles around the ring, dropping gumshield and dentures in Rocky 14."
- **Thomas Turnbull:** "Hurray we've finally managed to stop Windows 10 installing!"
- **Dwynneugh:** "So Corbyn is now against Brexit is he?"
- **Robin Black:** "The only time moviegoers laugh during Adam Sandler's new film: when they're told it's meant to be a comedy."
- **Thomas Turnbull:** "We've just won the Spanish lottery and We didn't even buy a ticket!"
- **Dave Norton:** "Rich tax dodgers running scared from George Osborne."
- **Dwynneugh:** "So Windows 10 is less obtrusive than Windows 95 - we don't believe you."
- **Terry Martin:** "How the rest of the world sees the US presidential elections."

The winner, though, is Darren Baker "Users react to the price of Amazon's new e-reader."

If you have a caption for the picture below, head to the 'Other Stuff' section of our forum (forum.micromart.co.uk), or email us your funnies via caption@micromart.co.uk, remembering to add the issue number to the email.



Yikes! Web Host 123-Reg Deletes Customer Websites

Hundreds reported to be affected by "mistake"

There are errors, there are big errors, and then there's this. Website host and domain registrar 123-Reg has accidentally deleted an unspecified number of its customers' websites as a software error during a clean-up of its virtual private server systems has "effectively deleted" the sites. There was no confirmation of just how many were impacted at the time of writing with the firm labelling the

impact as affecting a "minority" of European customers.

According to the BBC the host doesn't have a backup of the data although it's likely that the customers themselves will have had a backup in place so, hopefully, the potential backlash on this might not be as great as it could have been. Still, this is a big headache for all concerned and those affected will clearly not be pleased at the trouble this will have undoubtedly caused.

Cinema Chain Ditches Mobile Plan

US chain turns back on plans

US cinema chain AMC had said that it was going to allow audience members to use mobile phones during screenings, which was a somewhat controversial decision. Now, this rather silly idea is not at all going ahead.

The chief executive at the chain had previously said that it might encourage some mobile-savvy audience members to turn up more often, but as initial murmurings of the plan came to

light on social media, reaction was not good. AMC listened and plans have been altered. "We have heard loud and clear that this is a concept our audience does not want," it wrote in a statement. "In this age of social media, we get feedback from you almost instantaneously," it said in a statement. "This is an idea we have relegated to the cutting room floor... there will be no texting allowed in any of the auditoriums at AMC Theatres."

Good sense prevails.

Snippets!

Chrome Hits 50

More Google news for you now as version 50 of its Chrome browser has been released. The headline news for the half-century release is, however, the end of updates and security fixes for a bunch of operating systems: Windows XP, Windows Vista, OS X 10.6, OS X 10.7, and OS X 10.8. We were all warned that this was going to happen back in a blog post from last November, though, so we guess it's fair enough.

YouTube 360° Streams

Have you ever wished that you were at a live concert event but you just couldn't make it that night? Now YouTube is offering the next best thing – a live-stream of events with 360-degree video and audio.

The recent Coachella festival was the first event to use the technology and with virtual reality clearly emerging as the break-out tech trend of the moment, it stands to reason that YouTube would want a slice of the action.

WWDC Due For June

Apple has officially announced that this year's Worldwide Developers Conference will take place between 13th and 17th June in San Francisco.

The official announcement was accompanied with a truly dreadful poem from the company but putting that to one side, expect announcements regarding iOS, OS X, watchOS and tvOS. As for hardware announcements, it's too early to say but we're not expecting anything you'd call 'groundbreaking'.

Good. We didn't want to go all the way to San Francisco anyway. Honestly.

Web Designer Package For Year-Round Use

First 365 update guarantee for Xara

Software outfit Xara has unveiled its first release under its new 365 Update Guarantee, Xara Web Designer 365.

Anyone who buys the company's 365 products is effectively buying a perpetual license to the very latest version of that software title, also giving them access to new features and content as they are developed (providing this is within 365 days of the purchase). The 365 label also gives free inclusion of all supporting online services – such as hosting and cloud-based

Xara Online Designer – during that first year of ownership.

As for the core Web Designer package itself, features include parallax scrolling, an update to its SmartShapes concept to include more complex objects like smart charts and photo grids, enhanced photo editing tools and the addition of simple vector graphic symbols to websites, such as social media symbols.

The Premium version of the package, which retails for £70, includes an upgrade to a web hosting service with 2GB of free web hosting space, free

for a year. If you're an existing user, you can upgrade for £40 for the Premium version and £25 for the Standard version. Interested buyers should visit www.xara.com/uk.



Budget Fitness Band For iOS And Android

Will it change your life? Probably not, no

Fitness trackers continue to flood the market with their promises of helping us to stay active while offering some digital encouragement. Now, there's a cheap-as-chips option from Archon to add to the list of options out there.

The Archon Smart Touch is a £30 touchscreen wristband that can be paired with either iOS or Android smartphones to provide the "real-time notifications" part of the equation. As for the fitness-side of things, the watch details data such as steps taken, workout intensity, calories burned and distance travelled and it can also set workout targets for a more intensive fitness regime, thanks to the free Archon Touch app.

Achievements can be shared via Facebook while the wristband can also alert of incoming calls and messages, social media messages, emails, calendar events and reminders. The three-point touchscreen features a clear OLED display with swipe actions to scroll through the various data and this is also rated as shower- and rain-proof so it's good for all weathers.

The Archon Touch is available in the UK exclusively from online seller **Box.co.uk**.



Professional Video Editing In Consumer Package

Lots of features in this one

Software specialist Magix is pitching its Video Pro X video editing software as the best choice in its price class for video enthusiasts. Aimed squarely at the more ambitious video editors among us, it promises broadcast-quality results with improved performance and powerful tools in what is pitched as a professional editing package.

The main features in a long list include 360° camera editing, multi-cam editing on up to nine tracks, a plug-in package from NewBlueFX that comes with five professional filter effects, surround sound editing and support for the latest H.265 codec to compress video content from 4K cameras. There are over 250 new title templates to choose from too alongside native ProRes support and support for OpenFX plug-ins.

No-one can tell you that this is cheap because at £350 it most certainly isn't, but if professional-quality videos are your aim then this could be worth looking into. Importantly, a free 30-day trial is available at www.magix.com to help you decide. We do like a free trial.



Do You Know Your Passwords?

Two-thirds rely on auto-fill

Well this is positively frightful news.

According to security software outfit Bullguard, UK users are potentially in a right old pickle when it comes to passwords.

The firm has carried out a survey that looks at the login preferences of 2,000 UK adults when browsing the Internet on a phone or tablet. The survey has uncovered that nearly two-thirds of UK adults are reliant on auto-fill to complete the login process for some or all websites and a third automatically store bank card details to shopping sites online.

Should anyone doing this lose their mobile devices,

the financial losses could be significant, made worse by the fact that only half of respondents had set up a passcode for their mobile device. Three-in-five respondents are also open to problems from being permanently logged into social media accounts while 58% stay signed in to their email accounts permanently. Blimey.

People are obviously doing all this because it's difficult to keep on top of all of the online passwords we're required to remember but with eight in ten polled using auto-fill for "speed and convenience" perhaps people also need to think about security a little bit more.

New Kickstarter Campaign For Fuze

They've got a FUZEBOX and they want you to back it

Back in 2013, Fuze Technologies launched the Fuze for Raspberry Pi, a personal computer aimed at making coding easy. The firm has now launched a Kickstarter campaign for the Fuzebox, a simple 'plug and code' solution that just has to be connected to your computer via USB, wi-fi or Bluetooth before coding can begin in earnest.

The Fuzebox packages vary depending on what you're willing to donate but essentially they include Fuze BASIC coding language for Windows, Android and Apple

devices as well as everything else needed to get started: an electronic components kit (LEDs, switches, resistors etc.) printed project workbooks and a programmers reference guide.

As for the Fuzebox itself, that comes with eight programmable buttons, microphone, camera, GPS, gyrometer, accelerometer and magnetometer. The possibilities here are, if not exactly endless, still pretty substantial, certainly for creating games. If you want to support this project, you know where Kickstarter is.



Asus VivoBook Pro N552VW

Who says you have to spend £1500 on a high-performance laptop?

DETAILS

- Price: ~£1000
- Manufacturer: Asus
- Website: goo.gl/g4sFbR
- Requirements: Microsoft account for Windows 10

The new Asus VivoBook Pro N552VW is a mid-range laptop with some pretty impressive high-end components going in its favour. Although it's not specifically seen as a top of the range gaming model, it could quite easily stand toe to toe with some of the heavyweight examples currently available.

Inside you'll find an Intel Core i7-6700HQ processor running at 2.6GHz with a turbo frequency of 3.5GHz. There's an impressive 16GB of DDR4 memory installed, along with a 128GB SSD with Windows 10 Home 64-bit preinstalled and a further 2TB mass storage hard drive.

Graphics come courtesy of an Nvidia GTX960M with 2GB of GDDR5 memory, a GPU clock speed of 1097MHz, boost clock of 1176MHz, and a memory clock of 1253MHz. It's certainly a good GPU, one that'll keep up with the vast majority of modern gaming without too much trouble.

The 15.6" QFHD display manages a maximum resolution of 3840 x 2160, which is really quite an amazing thing to behold. It's ultra-sharp and looks absolutely magnificent when you view 2K/4K content; image purists and photographers will certainly enjoy the quality of the screen. However, it can seem a little close to overkill for the most part. Although the N552VW is a good setup internally it's not



▲ The Asus VivoBook Pro N552VW is a pretty impressive laptop



▲ Considering the specifications, it's a steal at £1000

really up to true 2K/4K gaming, and Windows 10 needs to scale everything up to 250% before it's readable at that resolution.

Connectivity is very good here, with three USB 3.0 ports, HDMI, mini DisplayPort, a single USB Type-C port, gigabit Ethernet, an SD card slot, and a combo audio jack. Wireless connectivity consists of 802.11 ac and Bluetooth 4.0. Interestingly, Asus has opted to include a Super-Multi DVD drive, which makes for a refreshing change in a modern laptop.

The keyboard is a standard full-sized Asus setup, if you've ever used one of the company's Vivo or ZenBooks before then you'll know what you're getting. Other than that it's a good feel, with decent travel and well spaced apart. The trackpad too is good, and supports the various Windows 10 gestures.

The design of the VivoBook Pro N552VW is equally similar to that of the other Vivo and ZenBook range. The keyboard section is a metallic grey colour with a swirling patterned

speaker holes to each corner. Externally there's a slightly brown brushed aluminium lid with a thumb print kind of design to it.

It's certainly a sizeable and weighty laptop this, measuring 383 x 260 x 29.9mm and weighing 2.53kg without the power brick. You can be forgiven for leaving it at home or the office if you commute daily, unless you're in training for an Iron Man contest.

The performance of the VivoBook Pro N552VW is extremely good. There's nothing it can't handle from everyday use, and video and photo editing is a joy thanks both to the great display and the high-end processor, memory and GPU.

Surprisingly the N552VW costs around the £1000 mark, with some examples being as low as £900 depending on where you shop. This is actually a really good price for a laptop of this specification, which goes to prove you don't need to hit the £1500 mark to put yourself ahead of the crowd.

We really liked the Asus VivoBook Pro N552VW. It's a great performer, has an incredible screen and despite being a tad heavy, will keep up with you for some time to come.

mm David Hayward

An impressive laptop with a high-end gaming spec



ScanJet 2500F1

Requiring a workspace reorganisation, Michael checks out a stand-alone scanner

DETAILS

- Price: £283
- Manufacturer: HP
- Website: www.hp.co.uk
- Requirements: 2GHz processor with 2GB RAM and 170MB of hard disk space running Windows 7 and later or Mac OS X with 1GB of hard disk space.



Rather than forming part of a multifunction device, the HP ScanJet 2500F1 is that rarest of things these days: a stand-alone A4 flatbed scanner. You might expect a stand-alone device to require less space on your worktop but this is not the case with this HP product. This flatbed's dimensions of 450 x 150 x 120mm mean it has a larger footprint than many of the multifunction devices I have seen recently. With a colour scheme that combines light and dark grey, the ScanJet 2500F1 is not going to be mistaken for anything else, however. It has a top-mounted ADF (automatic document feeder) with a capacity for 50 sheets fed through the unit for either single or double sided scanning that's conducted in a single pass.

Power and USB connection sockets are located towards the rear on the right side. Positioned on the left side is a row of buttons for power, scan, single/duplex toggle, shortcut scan and cancel operations. These buttons are slightly obscured by the overhang of the scanner lid. The reason for the overhang is to help when raising the scanner lid from the left side rather than the front where I expected it to happen.

I was also disconcerted a little when the setting up procedure did not follow the route mentioned in the installation guide. This document stated that the USB lead should only be connected when prompted by the software installation. However this prompt never appeared. Connecting the USB lead after the software installation has run its course solved the

problem as searches were automatically carried out prior to the connection being made.

HP has bundled a number of software tools with this scanner. Along with the TWAIN driver, you get a copy of the well-respected I.R.I.S. OCR (optical character recognition) software, which will need to be registered before use, and the HP Scanner Tool, offering a range of editing features.

With this tool kit you can opt to save scans as editable text for use with the OCR product, JPEG or PDF format. Scans can be directed towards a user-definable folder stored locally or sent to the Cloud where HP has set up a Dropbox option. You can also opt for scans to be attached to emails for distribution to others.

When setting up a scan there is a choice of document type and page size. The

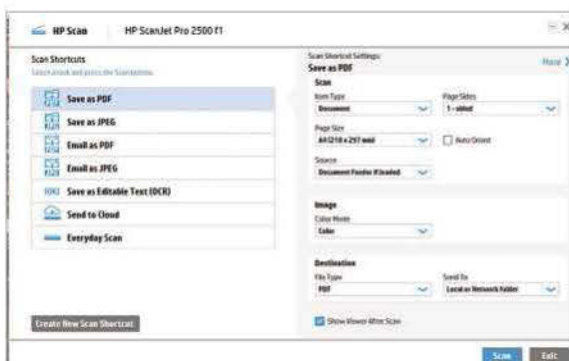
documents to be scanned can be fed from the ADF or placed on the scanner's glass plate if just a single page is involved. As mentioned you can go for a single or double sided operation with just a single pass being required when using the ADF. When using the ADF, the scan resolution is limited to 600 x 600 dpi. However by using the glass plate, resolution can be increased to 1200 x 1200 dpi.

While the various settings need to be adjusted from the tool kit, the actual scan operation can be instigated from the buttons on the scanner or the tool kit. However, you do need to be aware that the scan button on the device is deactivated whenever the tool kit is in use. Personally, I preferred using the tool kit for scan operations as you are shown thumbnail images of each page to help ensure quality.

HP has rated this scanner of being capable of producing 40 images per minute with two-sided scanning. My tests confirmed this figure when opting for JPEG, but the rate fell slightly to 38 images when using the PDF option.

mm Michael Fereday

A capable scanner, but overpriced



Asus ROG Sica Mouse

Is a gaming mouse for less than £25 too good to be true?

DETAILS

- Price: £22 from Box.co.uk
- Manufacturer: Asus
- Website: goo.gl/YSzYeY
- Requirements: USB port, Windows 7 or later for Armoury software

Gaming mice can be very expensive, coming in at well over £50. Cheaper options, then, are always going to be of interest to budget conscious users. Available from around £22, the Asus Republic of Gamers Sica is certainly cheap enough to deserve consideration, but is it actually worth it, or does it just represent false economy?

Well, like a lot of other budget mice from reputable brands (as opposed to the non-brand ones you might find on eBay), it offers some of the technology of its more expensive stablemates but also cuts out some non-essentials to keep costs down. In this case, that means no extra buttons beyond the main three (right-click, left-click and scrollwheel click).

Because there are no back and forward buttons, the Sica isn't particularly suited for web browsing, which severely limits its usefulness outside of gaming. If you don't care about such things, then obviously this isn't a problem, but personally, I use these buttons a lot, including in games, so their absence is difficult to forgive.

Also problematic is the lack of a DPI switch. Being able to quickly change the sensitivity of my mouse on the fly is something I've come to take for granted over years of playing PC games. Surely this, along with the



“ You might well wonder what qualifies the Sica as a gaming mouse ”

navigation buttons, would have cost pennies to add?

Without such features, you might well wonder what qualifies the Sica as a gaming mouse. Is it the oh-so-macho name, which means “a short sword or large dagger of ancient Illyrians, Thracians and Dacians” (thanks, Wikipedia)? Or is it the glowing

red Republic of Gamers logo on the lower part of the mouse's body? Or the fact that it's symmetrical and completely ambidextrous? How about the comfortable design and robust plastics and rubbers it's constructed from?

It's none of these things, really. Instead, what Asus is keen to tell

you about is the 5000dpi optical sensor, 30g acceleration, 1000MHz polling rate and separate left and right buttons for increased responsiveness.

What these actually translate to in real-world use is an impressively accurate pointer and buttons that provide a satisfying click when you press them. It's also worth noting that the switches beneath the buttons can be removed and replaced easily, potentially extending the life of the product – a feature taken from Asus's more expensive mice.

And like those other mice, you can tweak the Sica's settings using the ROG Armoury software. That also includes creating macros, but with so few buttons on offer, I'm not sure how useful this would actually be. You can also change the sensitivity, the polling rate, acceleration and the lighting effects for the logo. This is all useful but nothing out of the ordinary.

In the end, the Sica's appeal hinges on whether you rely on the features it's missing. It's a well-built, sturdy peripheral, and if you find it for less than £25, then its price is about right too. But if, like me, you can't live without navigation buttons or a DPI switch, then the Sica's plus points will count for very little.

mm Anthony Enticknap

Dependable but perhaps too limited



SanDisk Extreme Plus Micro-SDHC UHS-1 Card

Anthony checks out a card that won't slow you down

DETAILS

- Price: £21.75 from www.mymemory.co.uk
- Manufacturer: SanDisk
- Website: tinyurl.com/zbkrfke
- Requirements: Device that supports micro-SD cards

How much would you expect to pay for a 32GB micro-SD card? Probably no more than £10, even if you want a Class 10 card from a reputable brand. Why, then, would you spend more than 20 quid on one?

The reason is simple: speed. Looking at the packaging for this SanDisk card (also available in 16GB and 64GB capacities), there are a number of important figures and symbols to digest. For a start, the Extreme Plus is a UHS-I mark 3 card, which means it has to offer a minimum speed of 30MB/s. That's 20MB/s faster than a standard Class 10 card. That alone isn't bad, but what's even better is the theoretical maximum speed of 104MB/s.

Of course, theory isn't the same as reality, though, and SanDisk only claims speeds of up to 95MB/s for this card. Still, that should be plenty for 4K video recording – another claim that's made on the packaging.

Indeed, if you've ever suffered the pain of a sluggish camera, then this kind of speed will eliminate such problems. And even if you just stick this card in a smartphone or tablet, you'll potentially benefit from



much faster transfer speeds when filling your device with media files.

But like theoretical speeds, the claims of manufacturers should also be taken with a pinch of salt. For a start, what



68MB/s, which is far in excess of what we've seen in cheaper Class 10 cards we've used in the past. Also, when we tested it in an Android phone, file transfers were much faster than with our standard Class 10 card.

This is great, but if there's a question mark here, it's hanging directly over the price. Many sellers are listing this card at around £30, which is much too high. We found it for £21.75 at

Indeed, reviews suggest its performance is comparable.

Bearing this in mind, why are users charged a premium for SanDisk's card? There's no doubt it does its job, and it does it admirably, but such a price difference has to be accounted for. Well, according to SanDisk, it's temperature proof, waterproof, shock-proof and x-ray proof. That's great, but most SD cards are reliable enough these days that this is barely an issue.

What's more appealing is the lifetime warranty (or 30-years, depending on the region in which is purchased). The Toshiba example we cited earlier in this review only offers five years, and although there's nothing to say that card won't last forever, as least you know if SanDisk's card goes wrong through no fault of your own, then you're covered.

As expensive as it might be, that could well be what makes the Extreme Plus worth the extra investment.

mm Anthony Enticknap

“ If there is a question
mark here, it's hanging
directly over the price ”

is that 95MB/s for? As you might have guessed, it's a measurement of the read speed, not the write, which takes the shine of things a little. On the plus side, in our test, we achieved a maximum read speed of 89MB/s, which is much closer to the quoted speeds than we expected.

If you want to record 4K video, though, it's the write speed that really matters. And we're happy to report that our tests returned a write speed of

mymemory.co.uk, which is good, but at that same site we also found the Toshiba 32GB Exceria, which is a UHS-I mark 3 card, and it also has a max speed of 95MB/s – but at only £12.99, it represents a considerable saving.

Without testing this cheaper card, it's impossible to say for sure how it compares, but if it carries the same classification as the SanDisk Extreme Plus, then it should at least be suitable for 4K video recording.

A great SD card, but not a cheap one



Western Digital My Cloud EX2 Ultra NAS Box 8TB

Western Digital enhances its small NAS box design for small business users

DETAILS

- Price: £421.53 (Ebuyer)
- Manufacturer: Western Digital
- Website: www.wdc.com/
- Requirements: Network infrastructure.

When Western Digital launched its 'EX' Expert Series NAS boxes, many wondered why most of the best features went exclusively to the four drive units. The answer, it would seem, is relatively simple: Western Digital's most important products are hard drives. Therefore, each NAS box sale is an indirect means to potentially selling more drives, either bundled with it or post-sale.

That said, many small businesses don't require massive amounts of storage, but they do need something that can spit out files effectively, like the new My Cloud EX2 Ultra. This is listed in Western Digital's 'Prosumers/Creative Professionals' range, positioned as the smaller brother to the My Cloud EX4100. However, from the



“ The EX2 Ultra is a much more agile beast than the EX2 it replaces ”

outside it uses the same My Book styled exterior that was used in the original EX and EX2 designs.

With the possible exception of the 'Ultra' label, the two almost impossible to separate

visually. There still isn't a front facing USB port or a power button, for example – despite numerous reviewers complaining about these omissions before.

While those issues aren't addressed here, the EX2 Ultra has some enhancements over the EX2 that are definitely worth having. At its heart this NAS box has Marvell's ARMADA 385 dual core 1.3GHz processor in its corner, working alongside 1GB of DDR3 RAM. That's a

minor clock bump, an ARM processor with a dual core Cortex-A9 design (as opposed to the previous single core model) and double the RAM compared with the stock EX2. That's still less grunt than the EX4100 (which has a more powerful CPU and more memory), but places the Ultra neatly between that and its direct predecessor.

With still only two drives to control, the Ultra is therefore better suited to running installed apps on My Cloud OS 3, and also attaching more additional storage through USB 3.0. So what you're really buying here are future possibilities, with the assumption you'll never need the EX4100 levels of capacity and performance.

You can buy the EX2 Ultra in either a diskless configuration, or with 4TB, 8TB, 12TB or 16TB in a pair of pre-installed WD Red NAS drives. That enables you to run the system in RAID 0 or 1, JBOD or Spanned, subject to your priorities. So, depending on how important the data is on the system, you could either go for the maximum amount of available space or opt for redundancy, but only having two drives precludes prioritising both.

Diskless vs pre-installed street pricing

- £139.98 Diskless NAS
- £265.32 4TB (2x 2TB) Pre-installed
- £421.53 8TB (2x 4TB) Pre-installed
- £543.80 12TB (2x 6TB) Pre-installed
- £857.88 16TB (2x 8TB) Pre-installed





What the EX2 Ultra does deliver is raw speed. It's performance effectively maxed-out gigabit Ethernet for reading – at about 112MB/s – and hit well over 100MB/s for writing. That's servicing an optimal file size and a single user, but for a small server there is clearly more than enough horsepower in the Ultra to handle file serving duties. The obvious use for that extra power is installable apps, but that is where Western Digital isn't competing with the likes of Synology as much as its customers would like.

By default four apps are pre-loaded, but there are just 14 other tools you can add, including WordPress, Plex, Joomla, phpBB, Dropbox and Acronis TrueImage. I reviewed the original My Cloud EX2 nearly two years ago, and commented that the app selection needed to be expanded. The very modest increase we've seen since rather undermines Western Digital's ambitions in this sector,

even if its hardware has been good and competitively priced.

Where things are much better is in respect of the branded software tools that you can download to use in conjunction with the My Cloud OS, like WD SmartWare and WD Sync. These are really powerful, and useful.

The EX2 Ultra is a much more agile beast than the EX2 it replaces, providing both a boost in performance and responsiveness. Many users don't need more than a dual drive configuration, and with 8TB drives available now, it may be that four drive units are less of a necessity.

Looking at the pricing, buying the EX2 Ultra pre-installed is a much better choice, unless you've got a bunch of spare NAS-designed hard drives. An empty unit is less than £150, and it costs about £150 for two 2TB WD Reds, where the box with 2x 2TB installed is at least £35 cheaper than that. Moving up to the 12TB (2x 6TB) configuration you'll save about £65 by choosing pre-installed.



What I should also mention is that while a bare box start is more expensive, it would give you the option to use 1TB, 3TB and 5TB drives. These aren't offered pre-installed by WD – nor is the option to start with just a single drive and add another later.

That's plenty of choice in a single product, and if Western Digital could only commit more resources to the software side of the NAS range, they might be even more desirable.

mm Mark Pickavance

Another affordable performer for SOHO NAS buyers to consider



Dell Venue 10 Pro 5056

A business-class Windows 10 tablet, with a very good display

DETAILS

- Price: From £350
- Manufacturer: Dell
- Website: <http://goo.gl/JwfMZL>
- Requirements: Microsoft account, optional keyboard section



▲ The Dell Venue 10 Pro 5056 is a good tablet, with a very good screen



▲ Although a little chunky, there's enough connectivity for most users' needs

The Venue 10 Pro 5056 series is the updated generation of Dell's business line of Windows 10 tablets. As the name suggests this is a 10" tablet built around the classic Dell Venue chassis, but with a slight improvement when it comes to what's going on inside.

The Venue 10 Pro is powered by an Intel Atom x5-Z8500 1.44GHz processor and 4GB of DDR3L-RS memory. Although that's not going to set the world alight in terms of performance, running the pre-installed version of Windows 10 Pro 64-bit is perfectly fine along with a selection of productivity/Office-type products. Just don't expect the Venue 10 Pro to deal with anything too processor hungry. The storage specifications depend greatly on the different models available, the model we had available for testing boasted a decent 120GB eMMC SSD, but you can drop down to as little as 32GB.

The display is a very good 1920 x 1200 IPS multi-touch that's remarkably accurate and smooth to use. It offers a crisp output, with a good level of colour depth and higher than average brightness level too. Again it's good for most common business duties, but those who want a finer degree of image and video quality may need to look elsewhere.

The design of the Venue 10 Pro hasn't altered for some time now. This means that the unit seems a little thick these days compared to many Android-based tablets, but it does manage to pack in mini-HDMI, a full sized USB 2.0 port, a USB Type-C port (used to charge the tablet), and a micro SD card slot. There's also connectivity on the bottom of the tablet for pairing with a keyboard section.

Naturally you also get 802.11 ac, Bluetooth 4.0, a front facing 5MP camera and a further rear facing 8MP camera, and on this particular model there's even a Dell wireless 5809e Gobi 4G LTE mobile Broadband card. Suffice to say, there's ample connectivity for every user type.

The battery life on the Venue 10 Pro 5056 was reasonably good. With average use – browsing, word processing and so on – we managed eight hours.

So it'll happily last a commute or a business trip without needing to get recharged too regularly.

We've seen better Windows 10 tablets in the past, even though the OS never feels particularly great when in Tablet Mode, but the Dell Venue 10 Pro 5056 is a good model to consider for those who require a mobile business tablet option. Prices start from £350, with the review model going for a higher £450. That's not too bad, and if you're locked into Dell purchases then you won't go far wrong with the Venue 10 Pro 5056.

mm David Hayward

A good enough tablet for business purposes



AC Worldwide Star Wars Bluetooth Speaker

The Force is definitely strong with this one

DETAILS

- Price: £129
- Manufacturer: AC Worldwide
- Website: goo.gl/igNRSM
- Requirements: Bluetooth device, 3.5mm audio output for Aux, no allies of the rebel scum



With the release of the most recent *Star Wars* film, the Disney driven merchandising engine has gone into overdrive. Even now, several months after the film was launched, it's difficult to escape *Star Wars* related stuff.

One of the better examples of the movie merchandising we've seen recently is from AC Worldwide, in the form of a set of Bluetooth speakers shaped as either a Stormtrooper or C-3PO. In this instance we have a near-bust plastic representation of a Stormtrooper to test, but is this just a gimmick for fans only or is this speaker worth looking more into?

The first thing you'll notice is that the Stormtrooper speaker is surprisingly large, standing at 280mm from the base and with a circumference of around 700mm. It's a solid lump of plastic too, weighing 2.3kg and without any signs of cheap quality materials used. In fact the Stormtrooper is really quite a magnificent looking product, and if you've opted for the C-3PO version then you'll get a shiny gold metallic finish.

There's a high degree of precision here for the exterior

that isn't let down when you take a look inside. Within you'll find a reasonably powerful 102mm down-facing 10W subwoofer along with a pair of 32mm 3W speakers. The decent 2200mAh battery manages around three hours of continual use from a full charge, and AC Worldwide hasn't scrimped on technology either with NFC, Bluetooth 4.0, and HFP 1.6 wideband speech standards.

On the rear of the base you'll find connectivity in the form of an aux port, USB for charging your phone or tablet and a 9V power input, along with a power button. The front of base houses touch sensitive buttons for manual and Bluetooth connectivity, volume, track skip, play and pause. Interestingly there are also a couple buttons to control the bass level, which is a great addition that's often missing even from expensive speaker setups.

The sound quality is also really quite remarkable, with an equally impressive maximum

volume, deep bass and generous mid-range levels. While it won't replace your living room stereo, the Stormtrooper speaker is certainly good enough for most audio playback situations. One element that wasn't quite as good as the rest of the audio quality was the voice, to us this sounded a little crackly and distorted. It was acceptable, though, and you do get the bonus of the Stormtrooper speaking through a set of famous phrases such as "move along", as well as the sounds of blasters being fired when first pairing or when the speaker has been idle for a while.

Obviously there's the novelty value to the Stormtrooper design, but it's also a very good stand-alone speaker in itself. Furthermore, if you purchase two units they pair together and allow you to connect a single device to both simultaneously.

The AC Worldwide Star Wars Bluetooth Stormtrooper speaker comes in at £129, the same for

the C-3PO model too, with a slight saving if you buy a pair for £250. Are they worth it? To some degree, yes. If you're a fan of the films, then you'll love them, and the quality of the audio won't disappoint either. If you're after a powerful speaker and you couldn't give a monkey's about *Star Wars*, then you're hardly going to fork out £129, despite the audio quality. We, however, really enjoyed the Stormtrooper speaker and its novelty value.

mm David Hayward

Perfect for any Star Wars fan



BUYER'S GUIDE

Raspberry Pi Kits

The Raspberry Pi has captured the hearts and minds of the technology world with its diminutive form, reasonable cost and limitless possibilities.

Buying the RPi on its own is perfectly fine, but if you opt to purchase a kit, then you're getting something extra for your money. The question is: what and for how much? David Hayward looks what available right now.

Raspberry Pi Kits

FUZE

DETAILS

- Price: From £69.99
- Manufacturer: FUZE Technologies
- Website: goo.gl/LrebQ5
- Requirements: Monitor

If you're serious about using the Raspberry Pi for both programming and electronics, mechanics and robotics projects, then you won't find a better all-in-one kit than the FUZE.

Since its launch a few years ago, the FUZE project has expanded alongside the new versions of the Raspberry Pi. You can still purchase the original Model B FUZE, but there's also a special edition BBC Micro-themed version, as well as one that comes with a robotic arm to program.

What you get from the FUZE is an expertly designed programming and electronics workstation, all packaged in a superb BBC Micro-esque looking keyboard and featuring a Raspberry Pi at its heart. There's a section for the supplied 840 contact slim breadboard to fit next to the custom developed FUZE GPIO board, above the built-in 88-key keyboard, and all the relevant Raspberry Pi ports – HDMI, Ethernet and so on – are accessible from the rear of the steel casing.

The standard FUZE kit comes supplied with an electronics toolkit, comprised of various jumpers, wires, LEDs, sensors – both digital and analogue – and micro switches. There's a wireless mouse included too, and the entire kit is backed up with a set of well-designed project cards



▲ The BBC Micro model FUZE looks as wonderful as the original Beeb

that take you through the basics of the GPIO, as well as the custom designed FUZE BASIC and RPi OS that comes pre-loaded onto the 8GB SD card.

FUZE BASIC is where the project shines. While the likes of Python and Scratch are still present, the FUZE team decided on creating its own version of the classic BBC BASIC programming language. That might seem odd among more modern programming tools, but BASIC in many ways makes for a better learning platform, which you can grow into and eventually expand beyond. After all, it worked 30-odd years ago.

As well as the older-style commands, FUZE BASIC carries with it an extended array of graphical and control commands that can be linked to the GPIO. So in essence, you could write a BASIC game in which a wrong answer to a question will trigger an LED and beep from any attached components on the FUZE GPIO and breadboard.

This makes the FUZE a more rounded and certainly far more powerful educational tool than its nostalgic bearing presents. The motivational and

inspirational impact it can have on users is quite commendable.

However, the thing that will no doubt shock the majority of users is the price. The cost of the FUZE starts at £69.99 for the base model, £129.99 for the next model up, £179.99 for the FUZE T2-A that we tested, and up to £229.9 for the version that includes a robot arm. Bear in mind, though, that while this isn't the cheapest kit we've had through our doors, it's certainly the best we ever tested.

Despite the price, the FUZE is superb, and it's encased within a sturdy solid steel chassis with a higher than average degree of craftsmanship. It's certainly one of the better Raspberry Pi kits available and well worth checking out.



Maplin Raspberry Pi Advanced Kit

DETAILS

- Price: £64.99
- Manufacturer: Maplin
- Website: goo.gl/DCVCyN
- Requirements: Monitor, breadboard for electronics work

Maplin was one of the first high-street electrical retailers to sell the original Raspberry Pi. Since then, the company has expanded its RPi range with a decent number of individual products as well as full kits – including the FUZE.

The Maplin Raspberry Pi Advanced Kit consists of a Model B Raspberry Pi, an 8GB Transcend SDHC card with the latest version of Raspbian OS pre-installed, a micro-to-full USB cable, a powered generic four-port USB hub, a USB keyboard with a built-in trackpad, an N150 nano wi-fi dongle, a HDMI cable and an Iceberry protective case.

Basically, this little lot, when hooked up to a TV or monitor, will boot into the Raspberry Pi Foundation's OS of choice and give you access to the Raspberry Pi itself. However, we're not too sure where the 'advanced' part of the name comes from, as there's no breadboard setup, wiring or schematics. In reality, it's more of an extended starter's kit.

Having said that, not everyone is into fiddling around with the GPIO or using the Raspberry Pi as an electronics kit. For users who want to test the inherent programming abilities of the RPi, to simply play around



▲ *the Maplin RPi kit is certainly a good choice for starters*

➤ *However, it's not as advanced as it could be*

with the interface or use it as a media centre, this is a pretty solid kit to consider.

The powered hub is an interesting inclusion, as are the wireless keyboard,

The cost of the kit isn't too bad either. At £64.99, it's fair to say you could cobble the individual items together more cheaply, from various online sources. But when you

“ A decent enough buy
for someone who's starting
out with the Pi ”

trackpad and nano wi-fi dongle. It would have been far easier for Maplin to bundle an extremely cheap wired keyboard and mouse and leave the networking to the customer's spare Ethernet port on their home router. The hub, nano wi-fi and everything else, therefore, give customers a neater approach to setting up their Raspberry Pi and probably a more convenient method of getting it up and running.

consider the components, no matter how cheap or generic they are, the overall convenience of the kit is worth it.

The Maplin Raspberry Pi Advanced Kit is a decent enough buy for someone who's starting out with the Pi. There's plenty of scope to expand the kit later, plus the neat layout means you're never left feeling too cluttered.

It's true that it doesn't really deserve the word 'advanced'



in its name, but it would certainly make for a good birthday present or a new project. And at any rate, the case is a good addition to any RPi owner's collection.



Raspberry Pi Kits

ModMyPi Ultimate Raspberry Pi Kit

DETAILS

- Price: £61.99
- Manufacturer: ModMyPi
- Website: goo.gl/8EhkpU
- Requirements: Monitor

ModMyPi is one of the many online success stories associated with the Raspberry Pi. Since 2012, this company has specialised in producing and selling some of the best Raspberry Pi cases you'll find. Now it's has expanded considerably and offers just about everything Pi-related you could ask for.

The ModMyPi Ultimate Kit consists of a Model B Raspberry Pi 3; a Raspberry Pi Case of your choice from the ModMyPi collection; a Samsung SD card (8GB, 16GB or 32GB) pre-loaded with NOOBS (New Out Of the Box Software); a country-specific micro-USB power supply; a selection of HDMI, RCA, DVI or VGA cables; an Ethernet cable; a choice of wired or wireless keyboard and mouse; a wireless dongle; a choice of four- or seven-port hub; a Raspberry Pi heatsink kit; a Bluetooth dongle, and finally an SD card reader.

There are some interesting components in this kit, including the heat sink kit. Here we have a selection of three multi-coloured anodised aluminium heatsinks designed specifically for the different-sized main heat producing components of the Raspberry Pi: the Broadcom CPU, Ethernet controller and the small power regulator. This may seem like overkill, but if



▲ The ModMyPi Ultimate Raspberry Pi Kit contains pretty much everything you'll need to begin with



▲ The components used are high quality

you've handled an RPi after it's been powered up for a few hours, you'll soon come to appreciate the addition of a heatsink or three.

The level of choice involved here is also commendable. The choice of case, for example, includes anything from ModMyPi, Cyntech, PiBow, One Nine, Timber and

many more, and they make the entire kit feel a little more professional overall. The addition of a Bluetooth dongle and SD card reader makes connectivity and transferring content considerably easier than most other kits.

The ModMyPi Ultimate Raspberry Pi Kit may come across as being extreme,

with some unnecessary components added purely for the sake of increasing the list of extras, but that's not the case. Instead, we have a professionally put together kit that increases the enjoyment of the Raspberry Pi without bombarding users with too much niche technology.

However, it would be nice if the Ultimate Kit included a breadboard and some basic introduction to the GPIO. Maybe even a few electronics to get a group of LEDs lit up or a motor moving?

You certainly get your money's worth for £62 – considerably more than the Maplin Advanced Kit, at any rate. The choice of case, heatsinks, USB hub, mouse and keyboard and everything else all make for an excellent kit. For someone just starting to get familiar with the RPi, this is quite a selection and one we're fairly sure they'd be perfectly happy with. Those who want the RPi for more hobbyist pastimes, though, would probably forsake the alluring extras in favour of something else from the ModMyPi catalogue.



SK Pang Raspberry Pi Starter Kit-C

DETAILS

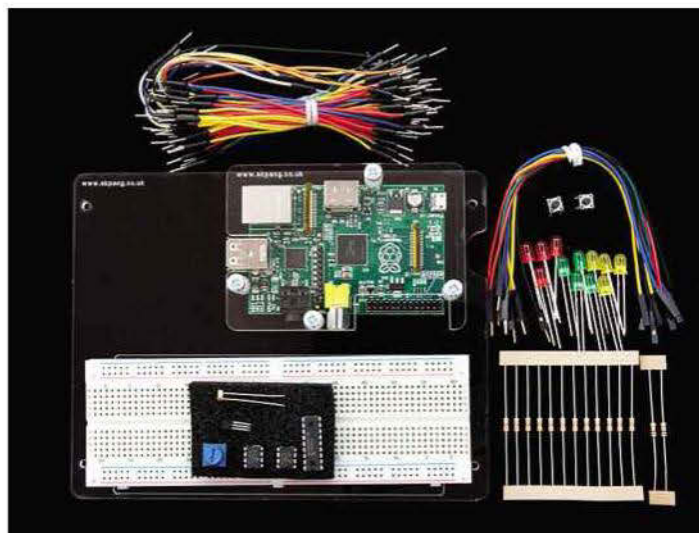
- Price: £74.28
- Manufacturer: SK Pang Electronics Ltd
- Website: goo.gl/vRvA4m
- Requirements: Monitor, SD card, keyboard and mouse, power

Where the starter kits we've reviewed so far have targeted a more generic type of Pi user, SK Pang Electronics has instead produced a kit aimed squarely at beginner or hobbyist electronics users.

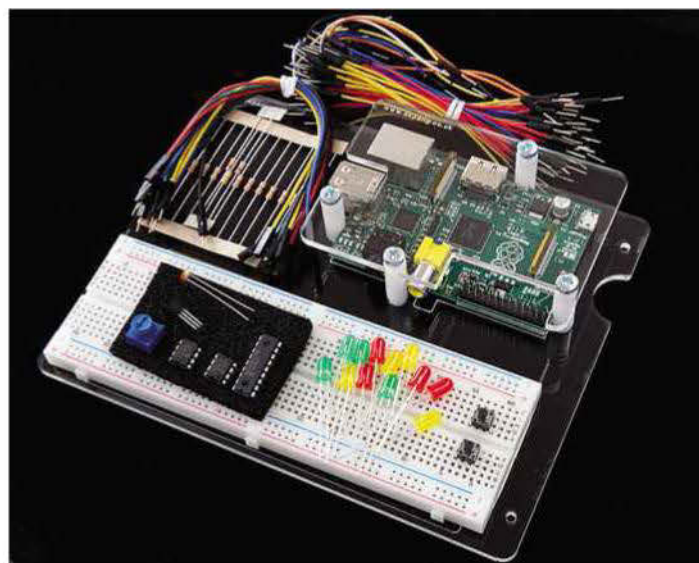
The Raspberry Pi, of course, was designed with a kind of late-1970s ethos in mind, that being a time when it wasn't uncommon for users to build computers from kits or to fiddle around with electronic components to build a radio set or something similar. SK Pang has fully embraced this with its Starter Kit-C and has included a selection of interesting project components.

The kit is comprised of a Model B Raspberry Pi 2; a Perspex cover and workbench; a breadboard with 840 contacts; 65 male-to-male jumper wires; ten male-to-female 150mm jumper wires; four lots of red, yellow and green 5mm LEDs; two mini push buttons; a pair of 10k resistors; twelve LED resistors, and a breadboard friendly Trimpot 10k potentiometer with an easy-turn knob.

And that's not all. With that lot, you also get an MCP23008 8-bit I2C IO



▲ The SK Pang Starter Kit is great for the electronics enthusiast



▲ You'll need to get the RPi up and running to begin with

Expander, an MCP3002 dual-channel 10-bit AD convertor with SPI interface, an MCP 4802 dual-channel 8-bit DAC with SPI interface, a TMP36 temperature sensor, and an LDR (light dependent resistor).

You will, however, need to get hold of an SD card with a Raspberry Pi operating system installed, as well as a keyboard, mouse and some way to power the thing and

connect it to a monitor. Of course, anyone who even remotely knows what the above components do won't have any trouble finding themselves the extras needed to get the Raspberry Pi up and running.

Naturally this isn't the sort of kit you'd buy someone without any prior electronics knowledge. Thankfully, SK Pang has other kits available for that, complete with a

book: *Adventures in Raspberry Pi* by Carrie Anne Philbin. This is a bit more advanced and the sort of kit you could purchase after users have already acquainted themselves with the ins and outs of basic electronics.

Admittedly, this does make the entire package a little niche. While the previous kits avoided the electronics and GPIO, this one does the exact opposite, although as we said, it's aimed at a particular consumer and not your average Raspberry Pi user. This isn't a bad point – far from it, in fact. And it does go to show the versatility of the board itself.

SK Pang has a number of electronics projects available in its catalogue which, together with the Raspberry Pi kit, mean you're going to be purchasing a package that's extremely well coordinated and comprehensive, from a supplier who really knows its stuff.

You do get a lot of electronics for your money, but a few extras such as an SD card and cables would have been a welcome bonus. All in all, though, it's a superb Raspberry Pi starter kit for hobbyists and enthusiasts.



Raspberry Pi Kits

The Pi Hut Raspberry Pi 3 Starter Kit

DETAILS

- Price: £50
- Manufacturer: The Pi Hut
- Website: goo.gl/fGpp0L
- Requirements: Keyboard, mouse, monitor, breadboard for electronics work

The Pi Hut is a Suffolk-based online store that's home to all things Raspberry Pi, Arduino, robotic, gadgetry and electronics. Although it's not as big as some of the other Raspberry Pi selling companies, the Pi Hut holds its own through its almost arcane knowledge of the device and its friendly service.

There are a number of kits on offer here from various sources, but it's the Raspberry Pi 3 Starter Kit that we're looking at in this instance. This is a very basic kit, but one that's put together to get you up and running with the minimum of fuss.

This starter kit includes a Model B Raspberry Pi 3; an 8GB SanDisk Class 10 SD card loaded with NOOBS; a 5V 2A mini-USB power supply available for UK, EU and USA plugs; a piano-black case, and 2m HDMI and Ethernet cables.

It may not sound like much, especially after reviewing some of the other kits here, but what this kit lacks in substance, it makes up for in quality and price.

The case, for example, isn't some shoddy 3D printed ill-fitting enclosure. It's a perfectly engineered and good-looking case embossed with the Raspberry Pi logo. The HDMI cable is a decent-



▲ Although there's not a huge amount here, the Pi Hut's kit is very good quality



▲ The case is excellent

“ Put together to get you up and running with the minimum of fuss ”

quality version 2.0, gold-plated connector, and the Ethernet cable is of the snagless Cat6e type.

The kit is also priced reasonably at just £50, which

is quite generous. Delivery time is on average a couple of days, and the kit is presented in a well-padded box.

However, the addition of a few extras would make

for a better all-round starter kit. Even a keyboard and mouse would make it more appealing to a wider audience and, depending on the type of keyboard and mouse, the price would still be lower than some of the kits of this kind from the competition.

As far as basic kits go, this is still a good choice. There are of, course, other extras available from the Pi Hut, such as GPIO breadboarding and wiring bundles, and you can purchase other items like the Raspberry Pi heatsink collection, all of which appear to be very reasonably priced.

This kit from the Pi Hut is therefore a simple and inexpensive way to get someone up and running with the Raspberry Pi. Where they take it after that is purely down to them, but as a gift and an introduction to the Pi, it's worth a look.



U:Create Raspberry Pi 2 Model B Camera Kit

DETAILS

- Price: £71.99
- Manufacturer: U:Create Education
- Website: goo.gl/ubAFb8
- Requirements: Monitor, keyboard and mouse, HDMI, breadboard for electronics work

U:Create Education has been producing kits for the Raspberry Pi since the original model was first launched. Since then, the kits have changed in content to become less focused on electronics and more on beginners.

Now the company deals with just four kits: Starter, Camera, Media Centre and Plug 'N' Play, all sold via CPC. In this guide, it's the Camera Kit we're looking at.

The U:Create Camera Kit consists of a Model B Raspberry Pi 2, a generic 8GB SD card with the latest NOOBS installed, a UK power supply, transparent acrylic RPi case, a wireless N adapter, a 36-page user guide for the Raspberry Pi and the NoIR 5MP camera board.

The kit is presented in a neat, colourful box with everything individually wrapped and labelled accordingly. It's a wonderful setup, and you can clearly see that it's aimed at younger users, as opposed to more mature technology adventurers.

But while there's an emphasis on younger users, the addition of a keyboard, mouse and maybe even a powered hub would be beneficial. That way, you



could buy a complete desktop setup for someone rather than having to look around for the parts that are missing and that you'll soon discover are needed as you begin to use the Raspberry Pi.

The case is a good choice for this particular kit. Unlike a generic RPi case, the included transparent model will allow the mounting of the camera board in a number of different ways – either within the case or by routing the ribbon connection through a handy slot for external viewing.

The user guide is okay; it's easy to follow and will walk you through the operation of the Raspberry Pi and how to get it up and running. It also includes a number of projects for you to try. The projects themselves aren't too difficult, but cover the camera function, as well as setting up *Minecraft*, creating a stand-alone media centre and using a breadboard with LEDs, buzzers and various other sensors.

Obviously, if you follow the book, then you'll need the

▲ The U:Create Raspberry Pi Camera Kit is good fun

◀ There could be more included with the kit, considering the price

extra breadboard and other electronics. These are all easy to get hold of, but it would have been beneficial to perhaps include everything needed for the projects in the book.

The U:Create Raspberry Pi 2 Model B Camera Kit is a good set, with the camera board, of course, being the most fun. A little more in terms of hardware would have been great, though, because at £72, this kit is a little too steep for what you get.



Your Letters

Windows 7 Update Problems

In *Micro Mart* Edition 1406, under the heading 'Search And Rescue', Jonathan N. Palmer complained to Ask Jason about not being able to update a new install of Windows 7, after downloading and installing Service Pack 1. In addition, he also installed Win 7 Pro, with SP1 included, but that also wouldn't update. Jason offered a number of possible solutions to the problem.

The following week, in Edition 1407, under the heading Offline After Update, 'Jonathan' complained of a similar problem to Ask Aaron, who also offered a possible solution to the problem. Prior to Christmas, I re-installed the 'N' version of Win7 Pro on my main computer and my laptop, as both were getting slow and needed rebooting. Both re-installs went without a hitch, as expected.

In February, I was given a LOGIQ M76T Notebook, which originally had Vista installed on it, but which the owner had decided to upgrade to Windows 10, only to cripple it completely. It also killed the optical drive, so he wasn't able to re-install Vista, nor Windows 7, so gave it to me.

Having installed a new optical drive, I then installed Win 7 Pro N 32-bit on it and soon found myself with the same problems noted above. Thinking I had a duff hard drive, I swapped in a new HDD, only to find the same problem again after downloading SP1.

Having an unused Retail copy of Win 7 Home Premium + SP1 32-bit, I installed that on the LOGIQ, but after a few security downloads, I again found the Update website refused to let me update the laptop, so decided to email you about the problem, but found that *Micro Mart* 1406 already had a report of problems and Jason's potential fixes, all of which I tried, but without success.

The following week, edition 1407 had Aaron's possible solution to the problem, but again, that didn't help, so I am stuck with a laptop which is effectively a 'sitting duck' for the hackers to

attack. At it is, I shall be using it only for Skype-ing my friends – no other software or Personal Data installed – so with a top-notch Internet Security package installed, I should be relatively safe... he says, hopefully.

In this week's edition of *Micro Mart* – issue 1408 – Mark Pickavance's six page article on 'Microsoft's Zero-sum Game' makes for interesting reading, a fact I have passed on to my many friends. It is becoming very obvious that these recent problems with being unable to update Windows 7 after installing SP1, are a deliberate and malicious attempt by Microsoft to kill off all previous versions of Windows and force us all to upgrade to Windows 10, whether or not it is convenient, whether we want to or not.

It is my considered opinion that, after 35 years of market domination by Microsoft, they have become too big for their boots and believe that they can dictate policy to Joe Public and big business when it comes to which Operating System they use on their computers. Over my dead body!

The day I switch on my computers and find they have been forcibly upgraded to Windows 10 'against my will', I will cease using Windows and convert to Linux, which I have been experimenting with for several years – despite the fact it's not entirely to my liking.

If Microsoft are so determined to force people to use Windows 10, then they are going to 'shoot themselves in the foot', which – in Military Parlance – is 'Self-Inflicted Injury', an offence that would find you in a court martial. This could well spell the end of Microsoft as the world leader in OS software, for which, they will only have themselves to blame.

Russ Betts



Distro Hopping

Yes I do, one of my favorites site was **distrowatch.com**, and I installed on many partitions, many HDDs, then I switched to virtual, but on all my pc there's a Ubuntu partition, just in case.

Lately I use pre cooked virtual machines from **www.osboxes.org** and others, but they're not very

updated and most of them don't even have vmware tools.

Ciao

Gianni
(from Torino, Italy)

P.S.the column after yours made me rush to eBay and grab an Amiga 600

Port Placement

Can someone tell Mark Pickavance to stop banging on about the Ethernet ports being on top of the device. I would guess Devolo put a bit of thought into this and I'm glad they put them on top. It means if I have to switch cables I don't have to ferret about under the device where I can't see the ports. The

aesthetic loss this might incur is more than worth it.

I imagine also that some people's electric sockets might be close to the floor, making it difficult fitting the cables underneath, although that's not a problem I have. Leave it out Mark, the positioning makes absolute sense.

Tony Allaway

Don't Give Up, Linux Users!

Prompted by someone else's remarks, I decided to write in, in the hope that it might get published.

Resisting Microsoft 'Update' efforts, I have been devoting my remaining strength to getting better, ignoring check-list medical and other advice to indulge in strenuous exercise, and instead sticking to my disciplined diet and non-stressful exercise regime, with results that have already astounded friends and relatives.

Despite being ousted from the Micro Mart computer forum by non-Moderating and New Philistine efforts, by using free 'no strings attached' BrucesWay installation on an 'old' but

SSD-enhanced PC, I have been able to create a triple-boot LinuxMint plus Win7 and Win10 PC, so as to verify the wisdom of Mark Pickavance's words about Microsoft machinations. Indeed, I intermittently still read his sensible words.

Having found that it still works on a USB-bootable PC with 'Legacy BIOS' capability, I would just say 'don't give up on free Linux, it may still work for you'.

I have also found that 32bit MATE Linux Mint Debian Edition 2 works rather well on a 16GB Sandisk Untrafit device.

Bruce R

GET IN TOUCH...

By email

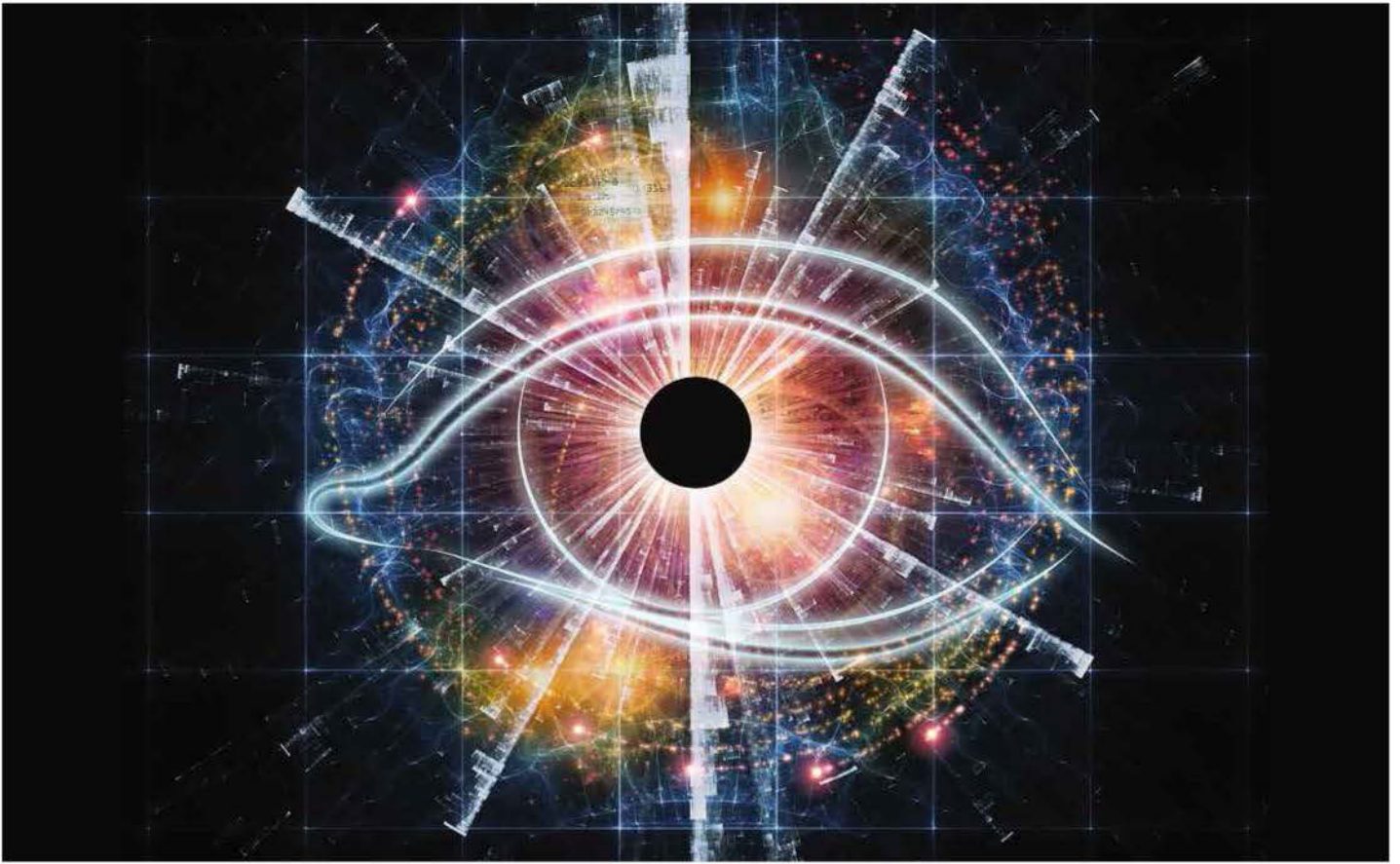
letters@micromart.co.uk

By post

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VR Capable Graphics Cards

VR is now a reality for the PC consumer, but to get the most out of it, you'll need a suitable GPU

Of all the technologies that make up the modern PC, there are few areas that have evolved more than graphics. We've come a very long way from the early magenta and baby-blue colours of EGA and the limited palette of VGA, and the advancement from the early days of 3D is mind-bogglingly immense. Where we were once impressed by the basic, clunky polygons delivered by the likes of 3Dfx and the early days of OpenGL, today's cards render the kind of visuals even supercomputers of yesteryear that filled whole rooms couldn't manage. Yes, when it comes to graphical performance, the PC market has evolved faster than we could have expected, and that evolution is about to make another jump. And it's not just a simple increase in **polygon counts** or render technology or even higher resolutions or faster frame-rates. Instead, the technology has jumped out of the screen and into the real world. Well, sort of.



▲ This is what cutting edge virtual reality used to look like. Impressive, eh?

in mind, we're going to take a look at some of the best cards around that should deliver a decent VR experience should you splurge on a new VR headset.

First, though, let's look at some of the basics of VR and what you need to look for in graphics technology.

VR Basics

It's highly probable that you've heard of virtual reality before, be it the aforementioned 90s tech or one of the many other implementations we've seen over the years. It's also likely you've come across it thanks to the latest wave of tech. Simply put, virtual reality is a method of fully immersing a user within a virtual world, usually using a special headset. This allows the user to look around virtual worlds in full 360° movement instead of being limited to seeing it on a flat TV screen. Audio is also used to further submerge players, using stereo and surround sound to bolster the illusion. VR has also used special gloves and other controllers in the past so people can manipulate objects in the virtual world, and there have been various methods of physical immersion using treadmills and other ambulatory devices. These kinds of peripheral are present in today's VR too.

The goal of VR is to give a user a far more realistic and absorbing experience, placing them within a world, so they feel more like an inhabitant and not someone simply looking in through a window. Some games are more suited to this, with first-person titles being the most fitting, as they already place the player in a more immersed position. Isometric RPGs, third person adventures and 2D platformers obviously don't have the same natural fit.

Early VR often used much more basic graphics, although at the time they were considered advanced, and the 3D models were usually basic shapes lacking textures. The VR effect was decent enough, but the virtual worlds were far from realistic.

The latest wave of VR uses the same graphical technologies as modern games, producing virtual worlds that are far more detailed and impressive – at least they can be. *Minecraft*, for example, has a version developed for VR and that game is far from realistic, but if a game developer wants to create a game with more realism, it can. If you've ever wanted to wander around worlds like those seen in *Skyrim* or even disturbing places like the many horror games that are available, now you can. Plastic pants are supplied separately.

Games have to be developed specially for VR however, so you won't simply be able to play any game using the hardware,



▲ 90s VR tech was considerably larger than today's models

Yes, virtual reality is back, having already surfaced a few times to date – most notably in the 90s with huge, grey arcade pods and the Craig Charles game show *Cyber Zone* (awooga!). This time, though, it's not limited to uber expensive hardware and large-scale machines. Thanks to ever-shrinking technology, the latest VR is small enough to wear comfortably on your head and is affordable enough for the home market. It's also not limited to dated graphics and specialised visuals. Instead, the new VR systems, like the Oculus Rift and HTC Vive, use the latest consumer graphics technology to bring virtual reality into the home.

Because of this and the fact games are as cutting edge as standard, graphically intensive titles, with the added strain of VR, any gamer wishing to get into home virtual reality is going to need a powerful system, particularly in the graphics card department. VR has a different set of considerations, with some elements far more important to the virtual effect. With this



▲ *Nvidia is pushing hard into the VR market and has some great GPU options*

although that may change. The HTC Vive is paired with SteamVR and offers support for older games, as one example. Usually, a game needs to be altered in order to support the VR tech and the new 360 degree movement and camera. Accompanying this is an elevation in PC hardware requirements, as your system will be doing much more work in order to handle the virtual world and the increased workload.

Probably the most important component in your PC when it comes to preparing for VR, the graphics card is the workhorse that renders the visuals making up the virtual world, and this is much more difficult when it comes to VR than it is for a standard game. Although visually the actual graphics may be similar in terms of texture mapping, lighting and so on, for VR to work, there needs to be a faster, smoother and more reliable frame-rate. It's recommended that the hardware needs to be able to sustain around 90fps. That's a lot higher than the traditional 30-60fps we aim for in standard gaming. The higher requirement is down to how VR tech works.

As stated by Oculus chief architect Atman Binstock on the Oculus blog (goo.gl/jjYYIz), standard 3D games have fairly straightforward real-time rendering requirements, and any dropped frames or lowered frame-rates aren't as problematic. For VR, however, such dropped frames and low rates would drastically affect the performance, as each dropped frame is far more noticeable, thus damaging the VR immersion.

"Traditionally, PC 3D graphics has had soft real-time requirements, where maintaining 30-60fps has been adequate," he said. "VR turns graphics into more of a hard real-time problem, as each missed frame is visible. Continuously missing frame-rate is a jarring, uncomfortable experience. As a result, GPU headroom becomes critical in absorbing unexpected system or content performance potholes."

For this reason, the team at Oculus came up with a recommended minimum GPU specification of an Nvidia GTX 970 or AMD R9 260 or 390. These cards offer 4-8GB RAM and DirectX12 support, and they're tagged as 'VR Ready'. Bear in mind, this is just a minimum spec recommendation, so it won't necessarily deliver the best performance. For this, you'll likely need to invest in a more powerful, more expensive model. In fact, it's pretty much a certainty. If you can stump up the cash for a multiple-GPU setup using SLI or CrossFire, all the better. In short, you're going to need a lot more graphical muscle than you would to run the same game normally.

Although we're not covering other components here, it's also worth pointing out the other PC specs, just to give you a more rounded idea before we look at the GPUs that should get you going in the world of VR.

First is the CPU, which will also be important, if not as much as the GPU. One of the minimum recommended specs here is the

Intel Core i5-4590, Core i5-6500 or equivalent. As long as you have a relatively recent quad-core CPU (Intel is usually preferred), you should be okay, so you should wait and test VR out before you upgrade, because you may not need to.

RAM will be as important as ever, but not too different to standard gaming. The average recommendation is around 8GB. This gives solid performance in today's standard gaming and will also work fine in VR. More RAM will be better, of course, but if you want to play it safe and not spend more than you need to, stick with 8GB for now.

Your motherboard will likely already be determined by your CPU. Ideally, you'll want a good board that can handle SLI/CrossFire and have plenty of room for expansion, such as more RAM, plenty of storage and so on. Overclocking abilities are also desirable, because gaming can always make use of the added speed this practice grants.

Storage is simple enough, and you just need to make sure you have the same kind of storage you require for gaming in general. SSD volumes will help, of course, thanks to the increased data transfer speeds, so if you need an excuse to upgrade to this, VR is a good option.

These specifications are only guidelines, and it's very early days for VR. We simply don't know yet how it will all pan out in terms of the core technology and how intensive games will be down the line. As VR and games coded for it become more and more advanced (if VR takes off in order to stick around), specifications may well grow. Then again, if optimisation of the tech gets better, there may be minimal growth in terms of power. Only time will tell how strenuous the technology will be on your PC, and this



▲ *Gigabyte Nvidia GTX 970 G1 Gaming Edition*



▲ MSI AMD Radeon R9 390X

will also differ depending on your chosen VR hardware. For now, though, this is a good guide, and it gives us some benchmarks to work with when it comes to recommending some of the better graphics cards right now for a VR PC.

GPU Options

Model: Gigabyte Nvidia GTX 970 G1 Gaming Edition

Price: £290

Gigabyte GPUs often deliver solid performance, and in terms of VR power that's no different. Although a card suitable for VR isn't going to be cheap, this sub-£300 model is a great option that may save you some cash.

The core specification of the card includes the Nvidia GTX 980 GPU and 4GB DDR5 memory. The base clock speed of the unit is 1,178MHz, and its boosted mode ramps this up to 1,329MHz. It supports up to 2560x1600 resolutions and HDMI7. The card also features the Windforce 3X cooling system, which uses three cooling fans to keep the card cool even under major stress. Pure copper heat pipes also help reduce this heat build-up. Another useful feature is Gigabyte's Flex-display tech. This allows the card to support up to four displays, and it does so automatically, able to detect and use any connected screens and adjust accordingly.

These are good specifications, and the card easily meets and exceeds the minimum requires spec offered by Oculus and will see you into the new wave of VR without breaking the bank.

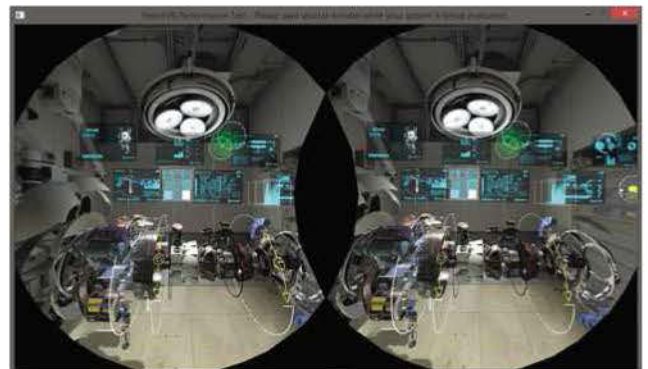


▲ EVGA GTX 970 FTW

Can You Hack It?

If, even after reading all of this, you're not sure if your PC is capable of handling VR, help is at hand. Valve has made a special VR test tool available via Steam that can run through a series of tests to determine your PC's suitability for VR.

You can find this at <http://store.steampowered.com/app/323910>. It requires a Steam account and installation, and once installed, it will run a *Portal*-themed benchmark that tests your PC's VR suitability. When it's finished you'll be given a summary of your system's results, with an easy indication of what needs upgrading, if anything. This will help you easily get a handle on your need to upgrade.



SteamVR Performance Test Results

Upgrade Required

Not Ready Capable Ready

System Specs

OS: Windows 8.1

GPU: Intel(R) HD Graphics 4000

CPU: Intel(R) Core(TM) i7-3630QM CPU @ 2.40GHz (8 cores)

Results

Your system isn't capable of rendering low quality VR and it appears to be mostly bound by its GPU.

We recommend upgrading your Graphics Card.

You can also try updating your Graphics Card drivers, closing performance-heavy applications, and running this test again.

Show Details

▲ Steam's VR test will tell you if your PC is cut out for VR or if it needs an upgrade

Model: MSI AMD Radeon R9 390X

Price: £350

Now this is interesting. This model from MSI costs less than £400 but comes with an impressive 8GB of RAM – twice that of the recommended minimum spec for VR. It also boasts an AMD R9 390X, which also meets the specification. This means you can easily meet the requirements for VR without having to spend anywhere near as much as some other cards.



▲ *Sapphire AMD Radeon R9 Nano*

Of course, in terms of overall performance, it's not as accomplished as other, more expensive cards, but in tests it's proven to hold its own and can handle most gaming content thrown at it, including VR. The R9 390X is powerful enough, and thanks to the 8GB of RAM, you'll find this will likely be a major upgrade if you've been waiting to do so for a while and are still limping along with a sub-4GB model. It'll also support 4K HD, so even if you don't plan to upgrade solely for VR and want to also get the most out of other games and movies, this is an affordable option.

Model: EVGA GTX 970 FTW

Price: £300

Coming in even cheaper than the MSI model is this EVGA offering. It's an Nvidia-powered board that features a GeForce GTX 970 and 4GB GDDR5. It's proudly tagged as 'GeForce GTX VR Ready', which tells you exactly what you need to know – this card can handle VR, and it does so on a budget.

Although it has half the memory of the MSI model, it's cheaper, and many users prefer Nvidia's line of chips, with a lot of game developers also leaning towards the GeForce line in favour of the competing Radeon. Of course, this is all down to preference.

Despite the lower price and less RAM, this is still a good performer, and in tests it easily handles most games and should handle VR well enough as an entry-level VR card. Don't expect benchmark-breaking performance, but do expect reliable operation.

Model: Sapphire AMD Radeon R9 Nano

Price: £430

Most of these cards are great for the majority, but what if you want to build a compact VR PC? Do you have any options open to you? Of course you do and this Radeon model from Sapphire is one such example.

The R9 Nano is, as the name implies, a compact GPU designed for smaller PC chassis, but it doesn't sacrifice much in the way of power for its smaller stature. Instead, it packs in a respectable R9 GPU running at 1GHz and 4GB of DDR3 SDRAM. As it's a smaller card, it also uses less power and doesn't have the same cooling requirements as full-size cards.

As this is a compact card, it's obviously lacking some of the power you'll see in larger, more expensive cards, but users have

Official Oculus PC Spec

For quick reference, here's the official minimum spec PC build from Oculus, including the GPU. Your PC should have a similar spec to this in order to approach VR performance. The cost of all of this weighs in at around \$800.

- **Motherboard:** ASRock Z170 Pro4S
- **CPU:** Intel Core i5-6500
- **GPU:** GeForce GTX 970 or Radeon R9 390
- **RAM:** 8GB DDR4
- **Power Supply:** 620W Seasonic M12-II
- **CPU Cooler:** Stock (or Cooler Master Hyper 212 Evo)
- **HDD:** Seagate Barracuda 1TB HDD
- **SSD (Optional):** SanDisk Ultra II 120GB
- **Operating system:** Windows 10

already commented that this makes for a great compact VR machine. Well worth consideration.

Model: Gigabyte Nvidia GTX 980

Price: £400

Hailing from the Nvidia GTX 980 line of GPUs, this Gigabyte offering falls above the minimum recommended VR spec and its 4GB DDR5 memory with 256-bit interface makes the most of the higher-end GPU. The base clock speed of the unit is 1,178MHz, and its boosted mode takes it to 1,279MHz. This may be slower than the Gigabyte GTX 970 on paper, but the more powerful GPU offsets this and can produce superior performance.

As with the other Gigabyte card, this model also benefits from the company's unique features, including the Winforce 3X cooling and the Flex display system. Although the latter of these won't exactly be of much use in terms of VR, as you won't be using your displays per se, having a card that's flexible enough for any situation is always a bonus.

Model: Sapphire AMD Radeon R9 Fury Tri-X

Price: £500

At around £500 this card from Sapphire, is a good example of the kind of power on offer from AMD's GPUs. The Radeon R9 delivers strong performance and has a core speed of 1000MHz. The 4GB RAM is high bandwidth and will help power your VR experience.

The cooling system of the card is impressive and is unique to the card. It uses Sapphire's own multi-heat pipe design,



▲ *Gigabyte Nvidia GTX 980*



▲ Sapphire AMD Radeon R9 Fury Tri-X

along with a triple cooling fan configuration. This setup allows the card to forgo the use of fans when running at low load, so it's silent, and the fans kick in when needed at higher loads.

Model: Asus Strix-GTX980TI-DC3OC-6GD5
Price: £630

All good things come in threes in the graphics card market it would seem, as this is another GPU that features a triple-fan cooler. This time it's a model that comes from Asus. Hailing from its Strix range, this is a GeForce GTX 980 Ti that runs at a core speed of 1,190MHz and features 6GB DDR5 running at 384-bit. It's a bit of a monster, and as it costs over £600, that's all for the good.

As with many Asus cards, this is a good option for overclockers, as it features Asus's GPU tweak and is factory overclocked already, so out of the box it'll run faster than most stock GTX 980 Ti options – no overclocking knowledge required. The card supports full 4K resolutions and, as you may guess, its specification makes it more than capable of running VR tech, making it a solid purchase for those with the bank balance to allow it.



▲ Strix-GTX980TI-DC3OC-6GD5

Cutting-edge VR Build

Here's an example of a high-end VR build, should money be no concern.

- **Motherboard:** Gigabyte Z170X-UD5
- **CPU:** Intel Core i7-6700K
- **GPU:** GTX 980 Ti
- **RAM:** 16GB DDR4
- **HDD:** 4TB Seagate HDD
- **SSD:** 512GB Samsung 950 Pro PCIe M.2 SSD
- **CPU Cooler:** Corsair Hydro H110i
- **Operating system:** Windows 10

Model: Gigabyte Nvidia Titan X
Price: £900

If you're looking for some of the very best graphical hardware for VR gaming, you'll want to be gazing in the direction of Nvidia's powerful Titan series, specifically the Titan X. Available from many vendors, here we have another Gigabyte offering, which we've chosen because it's actually one of the best value options, costing just under £900.

The Titan X is an immensely powerful beast for gaming in general, but also for VR. Its GPU is rated at 1000MHz, but of course, this isn't indicative of the overall capability of the card, and the Maxwell GPU is a powerhouse. It easily outperforms other cards and can handle full 4K with a single GPU. The card also features a huge 12GB of memory, with a clock speed of 3505MHz and a 7Gbps data rate. It offers 7Tflops and 200 Gflops single and double floating point performance, and because it's a single card, it doesn't pull the power of an SLI setup, which you'd expect to require for this kind of muscle. Even with all this going on, the card also runs quietly, thanks to its high-quality cooling fan and passive cooling.

Simply put, this is one of the very best GPUs you can get full stop, and for VR, it's an excellent option, if one that's a little expensive when compared to other cards that can also deliver decent VR performance.

These are just a handful of VR-capable cards you can find, and there are price ranges for most budgets. As long as you take into account the higher minimum specifications VR requires when you're shopping for an upgrade, you should still be able to find a good deal. Happy hunting! [mm](#)



▲ Gigabyte Nvidia TITAN X



8 Great Gifts For Gadget Lovers

Whether you're looking for something for yourself or a loved one, these sub-£35 goodies will do the trick

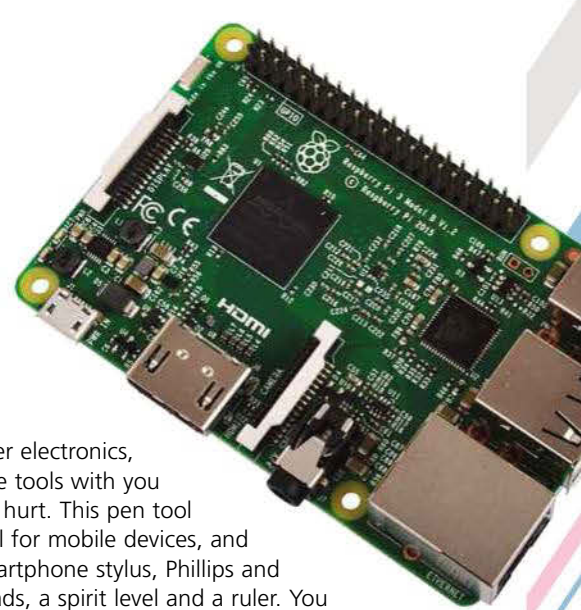
1 Frog Grippy Mat (£6.95, Prezzybox, goo.gl/r9Kvcq)

Although cars have glove compartments and other places where you can keep your stuff, sometimes you need to quickly put something somewhere in your car where you can see it, without having to take your eyes off the road. Your dashboard would be a good candidate, if things didn't have a habit of sliding around every time you go round a corner. The Frog Grippy Mat is a cheap and simple solution to the problem. This silicon mat just sticks to your dashboard, and then your keys, coins, phone or whatever sit on top and don't rattle around your car when you pull into a parking spot.

2 USB Mix Tape (£13.99, Zavvi, goo.gl/Okrq4P)

Although audio cassettes are said to be making something of a comeback (we have no idea why), there are probably loads of young people today who've never seen a mixtape in their lives. But whether they're old enough to remember recording songs off the radio or not, there's something undeniably cool about this nostalgic USB Mix Tape. Just be aware, though, that it's merely a 1GB flash drive in a pretty box, so it's a tad overpriced. The real value, of course, comes from the songs you put on it for whoever you gift it to.





3 CarBot USB Splitter (£9.99, IWOOT, goo.gl/hJLWQp)

Need USB ports to charge your phone in your car? Well, you can easily pick up an adapter for this job from a pound shop. That's all well and good, but we're willing to bet that it won't look like a robot. This one, from IWOOT (I Want One Of Those), does look like a robot. Will it charge your devices any quicker? No, of course not, but who cares when it looks so good?

4 Raspberry Pi 3 (£30, The Pi Hut, goo.gl/WbM7QC)

Looking for something a bit more useful? Then the latest incarnation of the Raspberry Pi makes a fantastic gift for a loved one or for yourself. Sure, the Raspberry Pi Zero might be smaller and it might seem cheaper too, but by the time you've bought all the extras you need to use it, you're better off buying the full-size Pi instead. Not only is it faster, it now comes with wi-fi and Bluetooth built in.

5 Wristband Magnet (£4.99, Menkind, goo.gl/VciLfe)

Whether you're building a PC or taking apart a tablet, you'll inevitably have to deal with a whole load of screws. The best thing to do is put them in a little pot or something, but if you want to keep a few on hand, then this wristband is ideal. Even if you're not looking for a gift for someone, this could be a useful purchase. Of course, some people might warn you about putting magnets near hard drives and other components, but there's nothing to worry about unless you're still using floppy disks.

6 Pen Multi-tool (£9.99, Menkind, goo.gl/Ef5wz7)

Although a full toolkit is a good idea for PC building and other

work with consumer electronics, having a few simple tools with you at all times doesn't hurt. This pen tool is particularly useful for mobile devices, and it comes with a smartphone stylus, Phillips and flat screwdriver heads, a spirit level and a ruler. You won't be doing any hugely complicated tasks with it, but if you need to quickly open up a smart device or tighten a motherboard screw, it will do the job in a pinch.

7 Bluetooth Gloves (£24.95, Prezzybox, goo.gl/we97e3)

Sadly, you won't get a little aerial coming out of your thumb like Inspector Gadget, but this Bluetooth device is about as close as you'll get to communicating like him without becoming a cyborg. Once paired with your phone, you'll be able to use your hand like a phone, speaking into your little finger and putting the speaker in the thumb to your ear. Yes, you'll look like a crazy person when you use them, and no you probably can't wash them, but you'll also feel like a secret agent, so it's worth the sacrifice.

8 Fire TV Stick (£34.99, Amazon, goo.gl/NG4cdV)

Let's end this list with something that's genuinely useful. For less than 35 quid, you can get this pretty decent streaming device from Amazon. It's not as powerful as the full Fire TV box or some of the newer media streamers, like the Chromecast 2, but it does a perfectly good job of providing access to services like Amazon Prime, Netflix and so on. And with just a little work, you can install Kodi, to turn it into a full media centre device. The 8GB of storage, in spite of being more than you'll find in competing streamers, won't be enough to store your content, but it's great if you intend to download a lot of apps. mm



Alphabet Pi:

David Briddock meanders through Raspberry Pi technology from A to Z

H

THIS WEEK: HDMI, HATs and Home Automation

HDMI

One of the great features of the Raspberry Pi is its built-in HDMI port, which connects to either a monitor or a TV.

However, setting up a display can be a little tricky sometimes, because there are lots of HDMI modes. Normally, video configuration settings are stored in the monitor as EDID data. When booting, the Pi asks the monitor for this data, which is then used by the Pi to set optimal display settings, so remember to switch on the display before booting up the Pi.

If you're still having problems, there's plenty of helpful information on the web, such as this Raspberry Pi Forum post: goo.gl/TNSyC6.

HATs

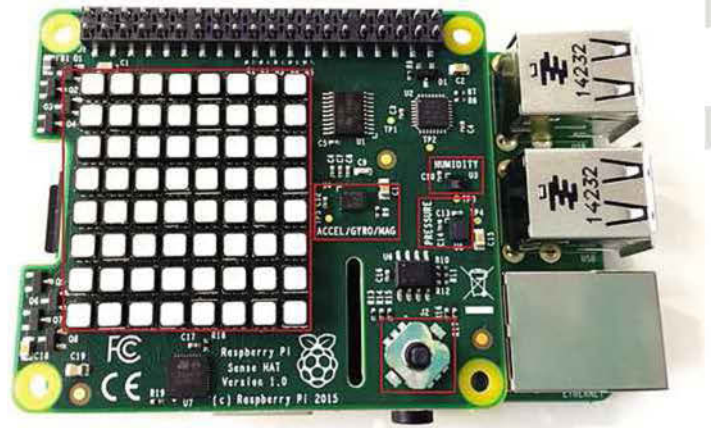
In July 2014 the Raspberry Pi Foundation introduced the Model B+, an updated version of the original Model B. One of the most significant changes was an extended 40-pin General Purpose Input-Output (GPIO) connector.

“ The Raspberry Pi is an ideal platform for home automation projects ”

The reasoning behind these extra pins became apparent just a few weeks later when the Hardware Attached On Top (HAT) initiative was announced. This initiative gave add-on board designers an officially endorsed specification which, when adopted, made Pi hardware hacking much easier. A Pi owner only needs to push a HAT onto the GPIO connector and boot up the Pi.

Essentially every HAT must conform to a specific set of rules, have the same basic rectangular 65mm x 56mm form factor, a 40-pin GPIO connector and four mounting holes that align with the mounting holes on the Pi. And to ensure anyone can design and build their own unique board, the complete HAT technical specification, including circuit diagrams, is open source (github.com/raspberrypi/hats).

The new GPIO pins ID_SD and ID_SC are reserved for an I2C EEPROM. This EEPROM holds the board manufacturer information, GPIO setup and a hardware description. The HAT



rules, and the EEPROM-stored data, enable the Pi to detect the presence of a HAT and automatically configure the GPIO and drivers for the board.

Home Automation

Did you realise the Raspberry Pi is an ideal platform for home automation projects? All you need to do is wire up some appropriate electronics circuitry to the GPIO connector, then add a little software code.

Now your Pi can communicate with other wireless technology or control electric power sockets and their attached devices including lights, fans, heaters and other computers. Connect the Pi to your wireless network and it's possible to control everything from the comfort of your settee using a smartphone or tablet.

Another possibility is to turn your Pi into a web server and connect it to the internet through your home router. Once it's set up, you can use a smartphone or tablet to send command messages remotely over the internet to activate or deactivate specific devices, or maybe receive notifications from a Pi-centric security camera and sensor system.

There are plenty of hands-on tutorials around, but make sure you choose one that fits your skills and experience. A project with lots of soldering and home rewiring won't suit everyone.

To fire your imagination, there's a home-automation compilation on the Raspberry Pi blog, which has everything from internet doorbells to home security and climate control to high-tech chicken coops (goo.gl/qYxPO6). [mm](#)

Remembering... Fighting Fantasy

Turn to page 25 to fight David Hayward, or continue reading for great treasure

At the same time that gaming on a computer was beginning to form, at least in the shape of the ZX81 and Atari console, another genre of gaming was experiencing something of a renaissance: roleplay gamebooks. It's a form of entertainment that can be traced back as far as 1941, with Jorge Luis Borges' *Examen de la obra de Herbert Quain*, a three part story that contained several different endings, prompting the reader to determine their path.

However, the gamebook that we're remembering here was the immensely popular *Fighting Fantasy* series. *Fighting Fantasy* was every text adventure lover's greatest game in book form. By copying the score card from the front of the book and armed with a sharp pencil, rubber and a pair of dice the reader could follow their character through dense foreboding forests, trap infested dungeons or far into the future.

Most of the series ended up as computer games in some form or another, *The Forest of Doom* being the more popular to find its way to the 8-bit machines, where you could buy the game and get the book for free! Other examples consisted of graphical adventures based

on the stories and could only ever be found at computer fairs or perhaps downloaded via a bulletin boards.

History

The *Fighting Fantasy* books were written by Steve Jackson and Ian Livingstone, after the pair co-founded the Games Workshop. The first book in the series, *The Warlock of Firetop Mountain*, published in 1982, has you play an adventurer seeking out the treasure inside a mountain where a powerful warlock has it locked up. You need to find two keys in order to gain access to the treasure, but doing so requires you to fight and use your cunning to outwit the dangers you encounter.

Each of the books was broken down into four hundred or so sections that corresponded to options the reader was given in a traditional adventure fashion. For example, you would be asked whether you wanted go North or South, kill the goblin or run away, open the box or leave the room? These choices then subsequently had you turning to the corresponding section as dictated by the option – 'turn to page 50 to grab the treasure and run', for example.

The formula proved to be extremely successful, but after a total of 59 books

Did You Know?

- Over 17 million *Fighting Fantasy* books were sold worldwide
- *The Forest of Doom* is available to play via Steam
- There were even some *FF*-inspired two player gamebooks
- The last book in the original series was *Curse Of The Mummy*

and as many computer game ports, the pair took separate paths. Livingstone went on to design games for Domark and then Eidos Interactive, while Jackson went on to develop the first telephone-based roleplaying game, set up Lionhead studios with Peter Molyneux and now teaches Digital Games Theory and Design at Brunel University.

Fighting Fantasy isn't dead, though, in 2002, Wizard Books bought the rights and began a new series, with *Blood Of Zombies* being the last title published in 2012. Will there be more? We certainly hope so.

The Good

Together with the scorecard you could really immerse yourself in the story. The fight for survival never felt so dramatic as when you had very little health left and you came across an orc.

The Bad

Let's face it, we all bookmarked the previous while turning to the next in case the outcome wasn't favourable – and decided to win fights without ever rolling a die.

Conclusion

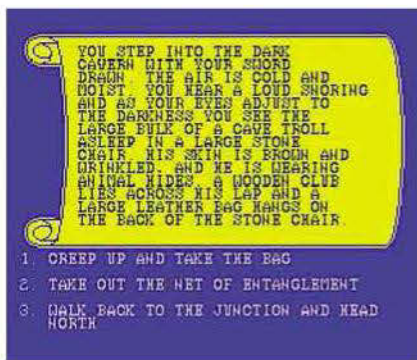
The *Fighting Fantasy* series was amazing and bridged the gap between digital gaming and books. Thank you, Messrs Jackson and Livingstone, for a great gaming concept.



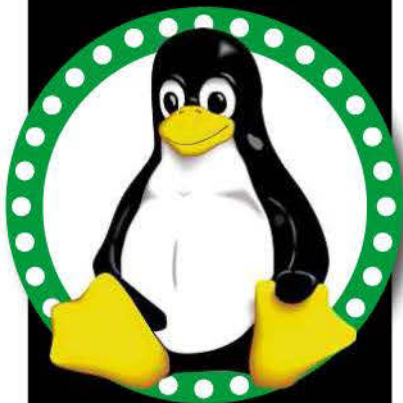
▲ The entire *Fighting Fantasy* series collection. Wonderful stuff



▲ The artwork within the books was incredible



▲ The forest of Doom on the Spectrum, complete with a free copy of the book



David Hayward has been using Linux since Red Hat 2.0 in schools, businesses and at home, which either makes him very knowledgeable or a glutton for extreme punishment

Linux

Pies And Games

A new look for RetroPie and a new version too

RetroPie has proved itself to be one of the most successful Raspberry Pi systems created by the community. Not only does it allow you to turn your Pi into a retro gaming centre, but it also lets you choose your retro system or home computer through a cleverly designed UI.

We've looked at installing RetroPie in the past, but now the project has had a facelift in the form of a new website, along with the release of RetroPie 3.7.

The new site is certainly looking very good indeed. There's a better order to the posts, and access to the community via the forums is much quicker and easier to search through. Moreover, the documentation is now easier to read through, as is the RetroPie wiki.

Along with that, version 3.7 offers some new experimental modules. There's the addition of the port of the classic DOS game *Star Control 2*, *The Ur Quan Masters*; *Xrick*, a port of *Rick Dangerous*; *SDLPop*, a port of *Prince of Persia*; *Cannonball*, an *Outrun* engine; and *Simcoupe*, which is a SAM Coupé emulator.

There are plenty of other additions too, with a new LXDE UI, UAE4Arm, an updated PS3 module and plenty of improvements and fixes throughout. The new version also includes some much improved config files, allowing for a better range of

controllers and more complex configurations of the various emulators packaged with the project.

An interesting new update is the packaging of Kodi 16, which includes joypad support.

a little more versatile than the previous one. This, of course, means you'll be able to launch LXDE from within the EmulationStation Ports menu and use the Raspberry Pi as a standard desktop, of a sorts,

“ The documentation is now easier to read through, as is the RetroPie wiki ”

Kodi, if you're not familiar, is the new project name for XBMC. The new version includes some 'heavy under the hood improvements' as the Kodi team states, with better event logging, context button (long press) addition, 4:3 stretching to 16:9, a number of add-ons and improvements to the music library.

A Versatile System

The inclusion of the LXDE UI makes this version of RetroPie

while still having the retro gaming centre fully operational.

Give It A Go

If you're interested in retro computing and you're after a great Raspberry Pi project, then head over to retropie.org.uk and take a look at the new site and version.

Until next week, folks.

▼ *RetroPie 3.7 is now out, along with a new look website*



News Bytes

More from the Amiga market, with Sven Harvey

SUM-CDTV USB Adaptor

The latest in a line of products from a company called Retro 7-bit, the SUM-CDTV USB adaptor allows the use of a USB keyboard (both USB HID and USB PS/2 type units) on the Commodore Dynamic Total Vision.

This is a limited edition follow-up project to the previously released Sum A234/CD32, which essentially did the same for Amiga 2000, 3000 and 4000 computers as well as Commodore's Amiga CD32 console. Retro 7-bit, who can be found at retro.7-bit.pl, has also done internal A1200 and A600 USB keyboard adaptors, as well as the Ryś adaptor to allow USB mouse and joystick/pad controllers to be plugged into the nine-pin sub-D connectors for mouse and joysticks on the Amiga and Commodore 64 range.

The products can be purchased from RetroAmi at retroami.com.pl.

Warp 3D Nova

Amiga OS 4.1 FE finally has a modern graphics system in the form of the Warp3D Nova API. This new software layer can be used alongside the miniGL and original Warp3D layers, but it offers shader-based 3D graphics and various other features taken for granted by PC users. You can find out more about the new development at goo.gl/M7M3aH.

Icaros Desktop

This preconfigured AROS (the A not standing for Amiga and being a recursive, meaning

AROS Research Operating System) desktop environment is for the x86/x64 hardware platform and is code compatible with AmigaOS 3.1 at an API level. A new version was recently released with upgrades to DirectoryOpus Magellan, OWB (browser) and various other feature upgrades and bug fixes. You can find out more at vmwaros.blogspot.co.uk.

AROS Vision

Another 'flavour' of AROS is the 68K version, which runs on original 68000 series Amiga hardware as well as the various emulations thereof and supports FPGA reimplementations. A new version of AROS Vision is now available, which is based on the 68K branch of AROS development, but includes freshly written ROM images that can replace the AmigaOS 3.1 Kickstart, to avoid potential legal issues. You can find out more at www.aros-platform.de.

AmiWest 2016

Taking place on 8th and 9th October, the 19th AmiWest show will be hitting Sacramento, California, USA this year. The event is being held at the Holiday Inn Express, 2224 Auburn Boulevard, and includes the usual Amiga-based exhibition, as well as following directly on from the fifth annual Amiga Programming DevCon led by OS4.x developer Steven Solie at the same location on 6th and 7th October.

For those with an interest and ability to attend, you can follow event progress and updates at amiwest.net/amiwest2016blog.



Amiga Works Documentary

Paul Kitching, who assisted Allister Brimble with the Amiga Works as the executive producer on the CD project, has been recording video interviews and is putting them together into a documentary about Allister's career and the development and production of the Amiga Works itself. The composer has created music for many Amiga games (while working with Team 17 and other developers and publishers), as well as titles on a plethora of machines from the C64 and Spectrum (*Dizzy*) to the PC, and many consoles including the XB1 version of *Goat Simulator*. More information should be appearing about the film on the album's site at [www](http://www.amigaworks.com).

www.amigaworks.com, where you can still buy the music, but you can find out more immediately at the documentary's Facebook page at www.facebook.com/amigaworks.



Sven Harvey has been our Amiga specialist for over 16 years, drawing on his 25 years retailing computer and video games and even longer writing about them

Amiga



HTC Doesn't Make Sense Any More

Ian McGurran checks out both HTC's latest and the book of sensationalist headlines...

Ian McGurran is a professional IT analyst, a semi-professional writer and a pretty amateur electronic musician. He likes gadgetry and loves making gadgets do things they were never designed to do

Mobile

HTC was once the leading Android handset maker, the Samsung of its time, if you will. Arguably it introduced one of the first genuine rivals to the iPhone in the Desire and demonstrated that the Android platform, when paired with excellent hardware, was a something to be reckoned with. At this time, Samsung was just about finding its feet with its Galaxy range, the S not yet released. The years following have not been as kind to HTC as they have to Samsung, and with a raft of mediocre handsets being HTC's answer to the growing behemoth that became the Galaxy S series, the Taiwanese company floundered, even flirting with financial concern.

The One series and later the M series added a bit of wow back into HTC's otherwise drab brown range. While each device was good in its own way (the One X's striking screen, the One M7's unibody aluminium chassis being especially notable), none reached the heights of that year's iPhone or Galaxy S. Could things be about to change with the HTC 10?

Surprisingly, the naming convention of HTC's One devices didn't help matters either. They were all the HTC One, just differentiated by their M-model suffix. Given they all also looked much the same too, telling a HTC One M7 from a HTC One M8 wasn't easy to do or say. Thankfully, that's ditched with the new 10. Yes, just 10 or HTC 10 if you prefer.

What else has changed? Like Samsung, HTC saw fit to skin its base operating systems, be they Windows Mobile (on the legendary HTC HD 2) or Android, and always with Sense. Initially, Sense made sense, as it gave a gorgeous user interface to cover over the less pretty ones that came as part of Android and Windows Mobile. But over the years, the Android stock UI has blossomed into something of a UI swan, while Sense (and other overlays, like TouchWiz) became increasingly bloated and overbearing. But still it stuck to them, understandably, because it gave its devices their identity to some degree. However, in 2016, HTC no longer includes Sense in its user interface. That's not to say it's stock – it's not quite, because it adds some nice friendly elements to the clean UI. But there's no mention of Sense anywhere, and what UI changes there are come in a far less overbearing way. What's more, HTC has worked with Google to ensure the basic apps like browser, email, contacts, don't appear multiple times. No

Android Mail and HTC Mail and Gmail and... you get the picture. Finally.

Phones have reached something of a technological plateau, with all the flagships generally having the same specs across the board (Snapdragon 820 SoC, Android Marshmallow, QHD screen), so you know whichever you buy will have more than enough power to handle what you want. The HTC 10 also offers an impressive 4GB of RAM too and keeps the micro-SD slot. However, now it's more about design and extras, and by extras I mean sensible ones, not Samsung's habit of throwing ideas at a wall to see what might stick.

In terms of design, the HTC 10's rear still harks back to the M-series, specifically the M8, but the front is a softer, more iPhone-6-like affair, and like the UI, it's more friendly for it. It's a hefty device too, so in the hand you feel the quality of the finish and the design. The M-series Ultrapixel camera finally makes good on the old promises of better light capture, and no

longer is detail sacrificed for low light use. In terms of extras, Quick Charge 3.0 means a 30-minute charge will give you 50% battery. Also, a 5MP camera joins the 12MP rear one, and the device supports 24-bit HD audio and headphones.

The HTC 10 certainly is an interesting prospect. It's a well-designed, attractive and, yes, friendly device that could give the S7 and 6S a challenge. It's good to see HTC back on the right track.



Robot Cause

Playing with Lego has always been a fun pastime, but Andrew Unsworth argues that it's never been a better educational tool

Last week, I talked about some of the great ways that modern computing technology is helping teachers to educate our children, and this week I'll continue the sermon. The Raspberry Pi and, hopefully, the BBC Micro Bit are helping children to understand the fundamentals of computing, such as the way a computer interfaces with its peripherals, how an operating system works and how a computer requires instructions to do anything useful. That is, a computer needs to be programmed so people can use it to achieve a goal, such as playing a game, creating a spreadsheet or simply window-shopping for Jags on the web. Otherwise, a computer is just a dull conversation piece or novelty doorstop.

One neat thing I saw recently was some Lego Mindstorms (£210, www.tesco.com/direct) robots in action. Lego has always been a great way of letting children use their imagination to construct buildings, cars, spaceships or anything else that they can dream up. The introduction of the Technics stream of Lego products a few decades ago allowed the use of more sophisticated components such as pneumatic tubing and pumps to create movement. This made the toy even more practical and educational.

As an example, I remember having a Lego Technics digger, and this had a pneumatically operated excavator. I slightly ruined it by cutting some of the piping a little too short and not leaving enough as 'slack' that I could then prune as necessary. As a result, some of the piping

fitted neatly when the digger was still but would pop off when I pressed the pump to move the excavator arm. This in itself was an important lesson for me, as I initially had no idea about pneumatics, and seeing the way that a bit of pumped air could make something move was an eye-opener.

Lego Mindstorms continues in this tradition and uses computers, sensors and motors to let children create robots they can program to behave and operate in certain ways. I find this pretty exciting and completely in step with this modern, computer age.

The current Lego Mindstorms set is called the EV3 (tinyurl.com/huvuefk), and it has a great website that provides lots of information, as well as what seems to be a thriving community of enthusiasts who create and publish new robot designs. I would have loved this as a wee nipper, and to be honest I'm sorely tempted to buy a set now.

Essentially, owners create a robot around a programmable 'brick' that looks like a first-generation Game Boy. Motors and sensors are connected to this brick, and users can even add a wi-fi adaptor. The brick is

powered by a 300MHz ARM9 controller, has 64MB of RAM and 16MB of flash memory, while a micro-SD slot lets owners use SDHC cards up to 32GB in size.

Mindstorms robots are programmed by choosing programming 'blocks' from a palette and placing them on screen to build programs that make use of arrays, variables, constants, functions and loops. This seems like a great approach, as it introduces children to key programming tools and concepts without scaring them off with a stark and intimidating multi-object C++ program. It also introduces the concept of software reuse by allowing users to create their own programming blocks that can be used again and again in different programs.

The Lego Mindstorms kits seems, to me, to be a very powerful way of instilling the principles of hardware and software engineering in schoolchildren, and in a way that is engaging and obviously creative. If Lego Mindstorms enthuses children and gives them a thirst for greater knowledge of robotics, engineering and computer science, that can only be a good thing.



Andrew Unsworth has been writing about technology for several years, he's handy with a spanner and his handshaking skills are second to none

Hardware



Ryan Lambie has loved videogames since he first stared up in awe at a *Galaxian* arcade cabinet in his local chip shop. 28 years on, Ryan writes about gaming for Micro Mart. He's still addicted to chips and still useless at *Galaxian*

Gaming



Fourth Gear

The insectoid threat of the original Gears of War trilogy is replaced by a new, more monstrous enemy in Gears of War 4

This week, Ryan takes a look at the new Gears of War, and checks out the unexpected problems in The Division's latest update....

Plug & Play

A decade is a long time in everyday terms, but in the videogame realm, it's like a hundred years. Consider all the things that weren't around when the original *Gears of War* came out in 2006: online platforms like Twitch and Kickstarter hadn't even been thought of yet. Microtransactions weren't yet a thing. Some people were still looking forward to *Duke Nukem Forever*.

Through all those years and all that change, the *Gears of War* franchise is still going and has even survived a switch in studios – in 2014, it was announced that ownership of *Gears* had passed from its creator, Epic, to The Coalition. Having released a cleaned-up, current-gen ready version of the original third-person cover shooter last year, The Coalition is preparing to unleash its first stab at a full-blown sequel: *Gears of War 4*.

Both in terms of visual style and action, *Gears of War 4* proves that even a series as stoic and unreconstructed as this one has to move with the times. When the first footage from the sequel emerged last year, we were befuddled to note that the first shot featured some flowers.

Then the new hero, JD Fenix (son of previous franchise hero Marcus), wandered into view. Confusingly, he had a neck like a normal person – gone are the comically chunky proportions of the original trilogy's characters. Yet the gameplay itself remains recognisably *Gears*: you still play a space marine with a big gun, which happens to have a chainsaw for a bayonet. You can still hide from enemy fire behind thigh-high walls. But now there's a twist: *Gears 4* introduces a new threat, which is currently being kept vague by the Coalition – it's alien, gooey, lizard-like and very angry. These ugly monsters appear to be less organised than the insectoid Locust from the earlier games, but they compensate by being more agile and aggressive. For one thing, they can now yank unwary players from the safety of their cover.

Other ways *Gears 4* is changing: The Coalition is hoping to draw in the e-sports crowd with a new and improved multiplayer mode.

"Now, as we're embracing *Gears* multiplayer," Coalition studio head Rod Ferguson told Gamespot, "we're saying, 'Okay, we're embracing wall bouncing and shotgunning.' One of the

things we're doing is we're making sure that the new, the social, the competitive, and the e-sports, are all being equally served. That's really where we're taking it further."

As for those new monsters, Ferguson – who also worked on the *Gears* games at Epic – says it's all part of making the franchise feel new and unexpected again.

"The Locust were just Nazis, and we know how to fight that fight," Ferguson said. "They became an understood enemy. What we are trying to get with *Gears 4* is that intimacy and tension where a single monster is scary again [...] It's about tension and how we make you nervous, make you anticipate something, have the sweaty palms."

Just in time for the franchise's tenth birthday, *Gears of War 4* is out on 11th October 2016.

Online

Successfully launching a massive online game is one thing; keeping players interested in the weeks and months after release is quite another. *Incursions*, the April update for Ubisoft's RPG-shooter hybrid *The Division*, added a healthy slab of extra content, including new gear and a new mission



▲ Cunning players found a way of glitching to the end of *The Division's* new mission, *Falcon Lost*. Ubisoft is currently figuring out how it'll "punish" players for exploiting the bug...

called *Falcon Lost*. It's fair to say that the update hasn't been without its setbacks, however. Shortly after launch, *IncurSION* players took to *The Division's* forums to complain that their agents – so carefully levelled up and customised after hours of play – had been deleted by the update. One player reported that he'd notched up 150 hours with his agent, which had abruptly vanished after the update was installed. Fortunately for those players, developer Massively has said that it's found the root of the problem – a malfunctioning server, apparently – and is in

the process of restoring players' missing agents.

Another unexpected problem has caused more disgruntlement – this time from Ubisoft's side of things rather than *The Division's* players. One of *IncurSION's* big draws is *Falcon Lost*, a tough mission intended exclusively for players at level 34 and above. Shortly its release, however, several players found a cunning glitch, which allowed them to clip through a wall, skip to the end of the game and kill the final boss without drawing any return fire. The result? Lots of rewards for almost zero effort.

Needless to say, Ubisoft hasn't been too happy about this. As YouTube videos appeared, showing other players how to exploit the glitch, Ubisoft hurriedly released a fix. The studio's community manager, meanwhile, wrote on *The Division's* forum that exploiting the glitch was "against our code of conduct," and that the game's makers are "looking into what can be done in terms of punishment for those who have exploited."

Exactly what Ubisoft will do to 'punish' players who've used the glitch isn't clear. As several members of the game's forum have pointed out, it's not necessarily the players' fault that so much of the mission could be skipped at launch. At any rate, it's just possible that some players will find their easily gotten gear quietly removed from the game by Ubisoft over the next few weeks.

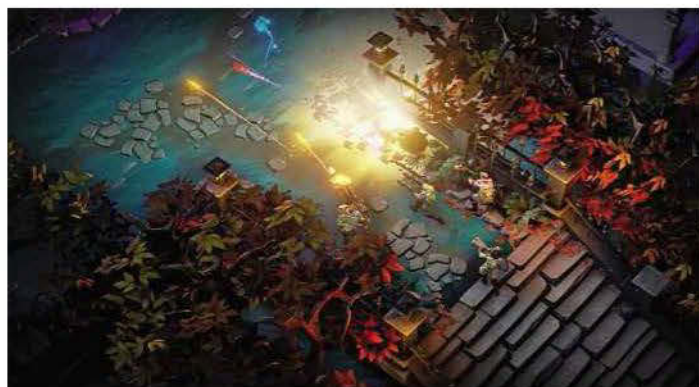
Incoming

Tie-in games were still a relatively new marketing idea when

Activision released *Ghostbusters* in 1984. Since then, we've seen far more *Ghostbusters* games than movies. In fact, 2009's *Ghostbusters: The Video Game* is even regarded by co-writer and star Dan Aykroyd as a canonical sequel to the hit films.

Ghostbusters makes a belated return to the silver screen this summer with an all-new reboot – and, in a case of history repeating itself, Activision is putting out a tie-in game to go with it. Taking the form of a twin-stick co-op shooter, it looks like a simple, fun arcade game in the mould of Atari's classic *Gauntlet*. Curiously, the stars of the new *Ghostbusters* movie – among them Melissa McCarthy and Kristen Wiig – have been replaced by some fairly generic-looking characters who look more like they should be running their own Shoreditch cereal cafe than fighting spooks. One of them even has a neatly trimmed beard.

Ghostbusters is out on 12th July.



▲ Just in time for the new *Ghostbusters* movie this summer, Activision is bringing out a tie-in game. It's a top-down shooter with local co-op play and lots of slime

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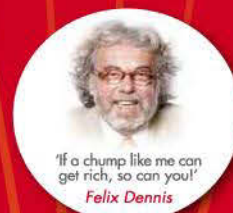
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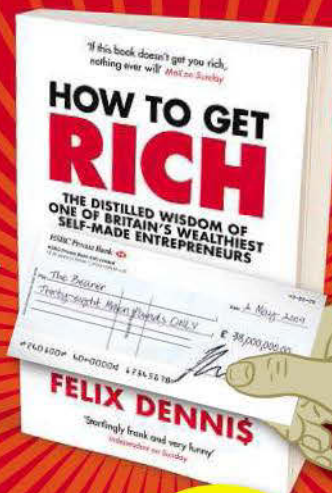
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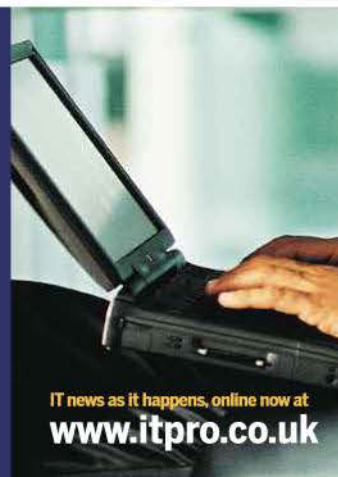
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Please try to keep your queries brief and limit them to just one question per letter, simply so we can squeeze in as many as we can each week. Please include relevant technical information too.

Aaron

Helpless

My laptop, which I've had for a year, is now unusable as I forgot the Windows password, and no matter what I do, I cannot get help with the issue. No one I know has much computer experience, so I can't get help from friends, and I've tried posting on tech forums, only to be told they won't help me. I've also tried looking for some software that can help, but I've been unable to find anything that doesn't cost a lot of money or online services that also demand a fee.

I'm really not sure what I can do and am at a loss as to why people on forums are reluctant to give me any advice. I'm really hoping you can provide some assistance as I'd like to be able to use my PC, and if I can, I'll make sure I never forget my password again!

Callum

The problem you're running into here, Callum, is quite common, and understandable. Simply put, moderators of online forums who help people troubleshoot problems cannot verify ownership of a device, so they're often reluctant to help anyone bypass a lost password for fear of helping criminal activities.

Of course, that's not to say this applies to you, but there's simply no way for the moderators to be sure, so they put in place a blanket rule of not helping people with such problems. In fact, if you take a system to an actual computer repair shop, they'll often ask for ID and proof of ownership.

Have you tried following the instructions provided on the login screen to recover a lost password? This really should help you solve the problem without the need to bypass the login via other means. You can go directly to the recovery service by navigating to account.live.com/password/reset. Here you can answer a few questions and reset your



▲ Unfortunately, lost passwords can be hard to find help for due to possible theft and illegitimate ownership



▲ Microsoft's password reset site should help most users who forget their login details

“ Try contacting Microsoft directly, as it may be able to help prove ownership ”

password. You can also report suspicious activity.

If there are problems with this, try contacting Microsoft directly, as it may be able to help prove ownership and provide assistance, although as stated on the actual knowledgebase website, it's only suggested to contact an admin in a network environment, or to use the

recovery service if you're a home user. Other than that, I'd simply recommend you perform a reinstallation of Windows, followed by the creation of a new Microsoft account. This is also suggested by Microsoft.

This will mean any data on the system will be lost, of course, but at least you'll have a working system at the end of it all.

Sussing It Out

I thought this might be useful. I've been reading in Micro Mart recently that people are finding that Windows Update gets stuck searching for updates. I thought I was the only one this happens to.

Like many Micro Mart readers, I'm the go-to man for friends and family when they have computer problems. I always update systems after I've fixed them and recently performed the free upgrade to Windows 10 many times. One problem I've found is that if the time and date are set wrong, then Windows Update will hang forever. Also if the time zone is set wrong, then the same thing will happen. Fixing these two things still doesn't always fix the problem, but I've found an excellent piece of software called WSUS Offline Update, which seems to bypass Windows Update completely.

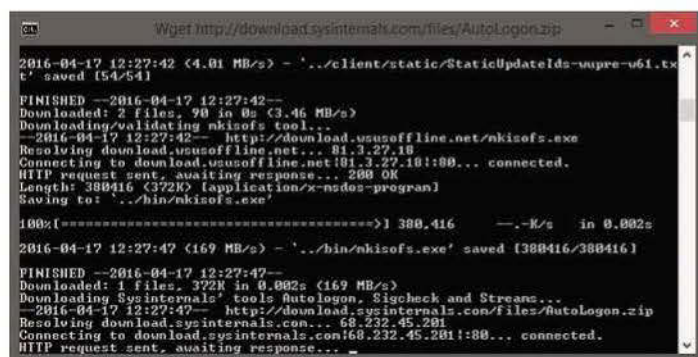
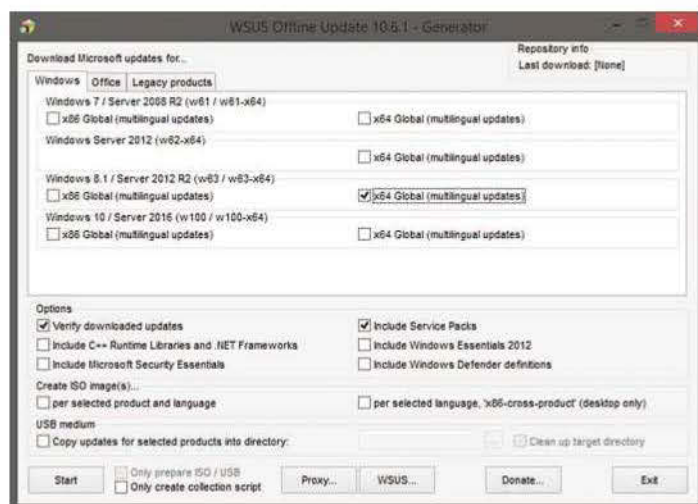
Hope this helps.

Steven

Thanks for your input, Steven. I'd certainly recommend people check this date setting if they're having problems. It's a much more straightforward possible fix than some others, so it won't hurt to check, and could save a lot of time.

With regard to WSUS, this is, indeed, a very good suggestion, and despite its usefulness, it's a tool that many remain totally unaware of. It's a free piece of software that basically allows you to download all of the relevant Windows updates to local media. With these updates downloaded, you can update Windows from the local store, meaning no connection to Microsoft's servers is needed, and you don't have problems with slow download speeds, high traffic and so on. You don't even need your computer to be connected to the internet at all to update Windows, and this is a major reason many professional technicians use it, including large-scale businesses that support sizeable networks.

The program is available from **download.wsusoffline.net**, and it's easy to use. The main menu allows you to select which updates you want to download, including .NET updates and Defender definitions, and you can pick the OS version you need. It can even download and store MS Office updates.



▲ WSUS is an invaluable tool for people who fix a lot of PCs and have to update Windows on a regular basis

There's also support for legacy software like Windows XP and Vista.

Once you have all this data, you can store it anywhere, such as a local hard disk, USB drive, NAS location or even optical media. With this, it's very easy to update Windows, and if you keep the data on portable media, you'll have a very useful method of updating any Windows PC.

DOS, Tres

I rather felt you omitted the obvious in your reply to Rob's query about older DOS software on new versions of Windows. What about FreeDOS? (www.freedos.org).

Alan

Yes, this is a very good suggestion and one that I'd definitely recommend for users who want to run DOS software, even if I neglected to mention it previously, so thanks for pointing that out, Alan.

FreeDOS is, unsurprisingly, a free tool for emulating MS DOS, and it's open source, with the source code freely available for anyone to utilise. As well as running older software, it's also a tool for developers to who can use it to support older software, and even develop new programs.

It's a nice package, and one that anyone with the need to run legacy software on modern systems should check out.



▲ FreeDOS is a useful tool for running older DOS software on new machines

ASK JASON



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While we try to cover as many questions as we can, we regret that Jason cannot answer your questions personally, but he'll cover as many as he possibly can each week. Please ask one question per letter and remember to include the full specification of your computer, including its operating system.

Jason

Go Pro?

My PC is based around a Core i7-4770K (LGA 1150) and a Gigabyte GA-Z97-HD3P. The boot drive's an old-skool spinner (2TB), which I want to replace with an SSD, and as the motherboard's got an M.2 slot, I'm planning to buy a Samsung 950 Pro (512GB). Will this run at full speed, though? Will real-world performance be any better than what I'd see from a standard SATA SSD? As it costs £240, I want to make sure I'll be getting my money's worth!

Keith, TalkTalk

The M.2 socket (the version found on desktop motherboards, anyway) exposes a SATA 3.0 interface and a SATA Express interface. The SATA Express interface can be configured as either a two-lane or four-lane PCIe slot, using either PCIe 2.x or PCIe 3.x. Now, PCIe 3.x x4 delivers a bandwidth of nearly 4GB/s. Lovely. At the other end, PCIe 2.x x2 delivers just 1GB/s. * Better than SATA 3.0's 600MB/s, but hardly a giant leap for humankind.

So how is the GA-Z97-HD3P's M.2 slot configured? Yep, you guessed it, Keith – as PCIe 2.x x2. The fly in the ointment is the chipset. All LGA 1150 chipsets, including the top-end Z97, only support PCIe 2.x, and only two lanes can be used for SATA Express. For a PCIe 3.x x4 interface, you'd need an LGA 1151 motherboard (and CPU) and an H170, Q170, or Z170 chipset. Another way to feed an M.2 socket is to branch PCIe lanes off the CPU (and LGA 1150 models do support PCIe 3.x), but desktop CPUs only have 16 lanes to begin with, all needed for the graphics slot. †

Samsung's 512GB 950 Pro is a PCIe 3.x x4 card, reading at up to 2.5GB/s and writing at up to 1.5GB/s. Clearly, those scores are far in excess of what your Gigabyte can handle. The 950 Pro would

work, but its speeds would be bottlenecked to 1GB/s across the board. Still far faster than any SATA 3.0 drive, of course.

Is it worth £240, though? Well, Samsung's best-in-class 512GB 850 Pro SATA 3.0 unit costs about £180, and the marginally slower 512GB 850 Evo comes in at just £130. So SATA Express drives certainly carry a significant premium. Also, monumental read and write speeds are only really utilised when metric tonnes of data are transferred

950 Pro, however). Read and write speeds will typically be the same for both, but IOPS scores are usually much higher via NVMe. In a nutshell, the higher the IOPS, the faster a drive can find the file you want to access or start writing to an empty block. The higher the number, the lower the latency, which is far more important for everyday use than crazy read or write speeds.

* The M.2 interface at PCIe

“ The higher the IOPS, the faster a drive can find the file you want ”

between drives with similar performance, or perhaps in short bursts when game levels are loaded. In almost all other circumstances, you'd be hard-pressed to notice any difference between the 540MB/s read speed of the 850 Evo and the 2.5GB/s read speed of the 950 Pro.

If you do decide to go for an M.2 SSD, Keith, be sure to buy one that uses the NVMe protocol, not AHCI. Sometimes the same model is sold in two versions (not in the case of the

2.x x2 is usually advertised as delivering 10Gbit/s. Once overheads are deducted, the real bandwidth is actually 8Gbit/s, which is 1GB/s (just divide by eight).

† Server-class CPUs – for example, LGA 2011-3 Haswell-E Core i7s and Broadwell-EP Xeon (up to 22 cores!) – usually have many more PCIe lanes (up to 40).

▼ M.2 SSDs are fab, but you really do need to do your homework



What A Pane!

I've had the same problem that Jonathan N. Palmer recounted in issue 1406. Following a clean install, Windows 7 (64-bit) refused to download any updates beyond SP1. It kept telling me 157 were waiting, but progress never got beyond 0%, even after I'd tried all of Microsoft's so-called fixes. This went on for a month. However, yesterday, with no input from me, Windows magically became up to date. What d'you make of that?

Steve Lynn, Northern Ireland

It's another case of JOOTT, I guess – just one of those things. As I mentioned to Jonathan, the update process was probably being scuppered by some program or other, and maybe in your case, Steve, that program recently got an update of its own, removing the block. I've often found that wondrous things can happen by temporarily disabling anti-malware tools, though of course that can leave a system vulnerable.

On Windows 10, at least in the Home edition, updates are set to automatic and can't readily be switched off. All sorts of magic can be weaved – both good and bad. More than once I've had exclamation marks in Control Panel that have vanished even as I've

been looking at them. Windows has deployed new drivers, without a word. I think I like that.

What I don't like is when the new drivers don't work. A few times now I've been in the situation where I've had a fully working system when I've shut down and a broken one when I've next booted up. Laptop touchpads seem to be a feature in this. A quick rollback to the previous driver usually does the trick (until the next time?), but for 'average' users it's likely to cause tears before bedtime. For Micro Mart readers, it's JOOTT.

▼ Sometimes you wonder if the torture will ever end...



Going Hyper

A week or so ago I bought a 256GB Kingston HyperX Savage USB stick. At £35, it was cheap, but the packaging looked legit and it seemed to work okay. However, I've now got suspicions. I bought the stick not only for its capacity but also for its speed, and I'm just not sure it's as fast as it should be. What's more, the eBay seller is apparently no longer a registered member. Have I bought a dud? How can I find out?

Peter, Gmail

That's very cheap, Pete. Suspiciously cheap. The proper price for a 256GB HyperX Savage is around £80. Frankly, I'd be staggered if yours was the real McCoy (the paprika flavour is the best). Sorry! eBay has cleaned up its act somewhat, but you still need to be careful. Fake USB sticks and memory cards are everywhere, and sellers and retailers are often innocent parties. Folks have been caught out even when buying from Amazon – direct from Amazon, that is, not via the Marketplace.

First off, download ChipGenius: goo.gl/2JJ6Mx. This will probe the Savage's flash chips and controller, identifying what hardware's in play. If you're lucky, it may also show the expected capacity. Crucially, look for the VID, the vendor ID. Bang this into Google to reveal the manufacturer. Kingston's ID, or one of them, is 0951. I expect ChipGenius will say something else. Of course, it's possible the VID itself may be fake, but dodgy manufacturers often don't go to that trouble.

Next, find out the Savage's actual capacity. No doubt Windows reports 256GB, but capacity can easily be fudged. You need to write lots of data to the stick to see how much it will truly hold. I'll wager yours will hit the wall at 64GB or less. The tool of choice for this test used to be H2testw (goo.gl/JAC0yk), but that's knocking on a bit now. A tool that's optimised for big capacities is RMPrepUSB: goo.gl/G5fIPt.

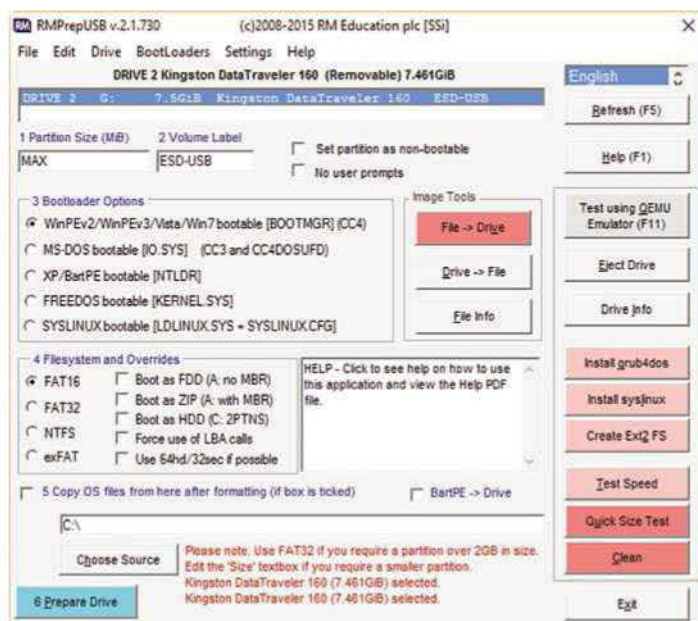
◀ Is that bargain-price USB stick or memory card the real McCoy?



First, click Quick Size Test (existing data will be wiped). This will also identify any read or write errors, as fake products often use flash chips that were destined for the skip.

Finally, click Test Speed. Assuming you've got it plugged into a USB 3.0 or 3.1 port, the Savage should attain around 350MB/s when reading and around 250MB/s when writing (those are the advertised speeds). If your stick is fake, you'll get nothing even close to those scores. If that's the case, or if any other results prove conclusive, get your money back, Pete. I'd advise you and other readers to run the above tests on all new USB sticks and memory cards (I think ChipGenius is only good for USB sticks), regardless of where they're bought from.

▼ Quickly confirm (or refute) capacity, integrity, and speed



Crowdfunding Corner

This week, we're looking at a pair of projects that are universal in different ways: one a universal remote, the other a universal charging solution

EZ Remote

Are you sick of losing your remote control? Or having multiple remotes for every device in your house? If the answer was yes to any of those, then this simple phone add-on might be what you need to relieve your anguish. The EZ Remote plugs into the 3.5mm audio jack on virtually any standard smartphone, adding a programmable IR receiver that'll allow you to issue commands to any IR remote-controlled device.

Compatible with thousands of TV models, the built-in app gives you access to standard controls right on your phone's touchscreen. It's mostly aimed at iOS users, since many high-end Android phones already have IR receivers built in, but should be compatible with other similar apps on other platforms (though check before you back!). If it works, you'll never need to hunt for a remote again.

The device is due to ship in August 2016, and you can receive one by backing \$20 (£14) or two by backing \$35 (£24). Greater discounts are available at higher tiers, especially if you're a retailer who wants to bulk order. The project has only just started its campaign but seems likely to reach its \$20,000 target – it's already 20% there after just two days, so prepare to see it funded before much longer!

URL: kck.st/26gp2x3

Funding Ends: Sunday, 29th May 2016



DoDock

When you've got several devices to charge, it's helpful to have something around to stop them being just a mess of tangled cables on a desk. That's why the DoDock could potentially be so helpful. This universal USB charger can power up a smartphone, smartwatch and tablet simultaneously, all while retaining a stylish and compact appearance.

With a built-in LED light that changes colour to indicate charging status, interchangeable charging stations, and even a charging 'ear' for your smartwatch, it supports two devices simultaneously (plus a watch) and contains both an Apple/Lightning and USB-C connector. Cables wind neatly inside the base unit, and you can even seamlessly integrate the Apple Watch's existing charging station. The popular Pebble Watch is also supported, thanks to a magnetic charging station that comes as part of the hardware.

Kickstarter backers can get a DoDock in Rose Gold, Gold, Silver and Space Grey for \$79 (£55) which is \$20 (£14) off the retail price. The project has hit its target, but there are stretch goals available if it goes far enough, such as a built-in Bluetooth speaker and LED clock pairing, so don't wait if you're interested in those. There's still plenty of time to hit those targets!

URL: kck.st/243zINm

Funding Ends: Tuesday, 10th May 2016



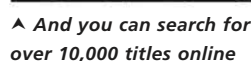
Disclaimer: Images shown may be prototypes and Micro Mart does not formally endorse or guarantee any of the projects listed. Back them at your own risk!

PlayZX

It's no secret that I'm somewhat fond of the ZX spectrum, as I'm sure many of you reading this are. It was, after all, a huge part of my childhood and the beginning of my obsession with all things technological.

games, I have always had to turn to my trusty PC and Emulation, but that's not the case anymore.

If you're into Spectrum gaming, then this is the app for you. Forget about all that emulation stuff, PlayZX neatly brings together the modern with the retro and lets you play your Speccy games on the original hardware – the way they were meant to be. [mm](#)



Logging Off

Here's a question that I've asked myself a few times; how much does flash memory cost? While the question seems straightforward enough, the answer is obviously nuanced by the form that the memory comes and how you buy it. A quick look at a popular online retailer determined that I could get 16GB of SanDisk branded flash in an SD card format (SDHC Micro SD) for £2.39, while a USB 2.0 key with that capacity is £3 from Toshiba and the USB 3.0 version is £4.

Working that back to per GB, that's between 15p and 25p for each gigabyte of storage. If you buy it in bigger 32GB and 64GB capacities those numbers can be lower.

Those numbers may lead the punters who feather Apple's palatial nest to (quite reasonably) wonder how the flash in their devices is different from the stuff that's 15p a GB? At the most basic level, the iPhone 6 and most of the currently available models use TLC (triple-level cell) NAND, like that used in most SSD drives. However, a quick price comparison there reveals that a 240GB Toshiba Q300 costs £50, or about 20p per GB – even cheaper than the stuff they use in some USB keys, evidently.

If that's the case, how does Apple explain the price differences between the 16GB iPhone 6S and the bigger capacity models? For example, the 16GB phone costs £539 here in the UK; the 64GB version is £80 more, and the 128GB model another £80 more than that.

As you start with 16GB, the first upgrade is the most expensive because you only get an extra 48GB for that £80. That's a whopping £1.67 per GB, or an 835% hike on the prices we quoted earlier. By comparison, the extra 112GB in the 128GB version comes at just £1.42 per GB. Though that's still 710% more expensive than a typical SSD.

If you thought that Apple was only aggressively gouging its customers with the iPhone, it shows almost the same lack of restraint elsewhere. Just spare a moment to pity those suckered into purchasing the iPad Pro believing they'd bought a PC of sorts. The basic wi-fi only model for the 11.2" iPad Pro is £679, and it comes with 32GB. The 96GB extra in the 128GB model is £120 and the 224GB boost to 256GB costs an eye watering £240. While the per gigabyte pricing in each case is less than on the iPhone, it's still more than 500% greater than the true cost of the storage.

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Which begs the question: how does Apple get away with this? Well, simply put, it seems to be able to do it because there are people who will pay stupid amounts of money for very little, as long as it's got the logo they like on it.



To be fair, it's not the only company which does this. Google charges £40 (£2.50 per gigabyte) for the upgrade from 16GB to 32GB on the Nexus 5X (made by LG), which adds up to a 1250% mark-up over retail NAND pricing.

What's worth noting in all these examples, however, is that Apple, LG, and all the others who pull the same trick, don't even pay retail cost for that memory. So, you'd presume, the real profit multiplier on their books is really much higher.

Mark Pickavance

LAST WEEK'S CROSSWORD

Across: 7 Atlantic Ocean, 8 Sylvan, 9 Daleks, 10 Inertia, 12 Issue, 14 Italy, 16 Prelude, 19 Moasil, 20 Senate, 22 Paleotropical.

Down: 1 Stay, 2 Waiver, 3 Stencil, 4 P-Code, 5 Scales, 6 Mark Hurd, 11 Notional, 13 Erosion, 15 Listed, 17 Line-In, 18 Blitz, 21 Team.

DISCLAIMER

The views expressed by contributors are not necessarily those of the publishers. Every care is taken to ensure that the contents of the magazine are accurate but the publishers cannot accept responsibility for errors. While reasonable care is taken when accepting advertisements, the publishers cannot accept any responsibility for any resulting unsatisfactory transactions. Sometimes we wonder if Mark Pickavance is inside our heads, or has some sort of Orwellian surveillance system keeping tabs on what we're up to. If you've read his column up there this week, it will no doubt amuse you that, just prior to opening these pages for checking, we were browsing the Apple Store

online wondering if the new, smaller iPad Pro would be a worthwhile investment... Actually, scratch that, there was no 'worthwhile' involved in the equation (nor 'investment', if we're honest), we just wanted one. Which we guess is Apple's modus operandi, isn't it? Like many luxury items, they make you want them even though you're not quite sure why. It's a neat mind trick, and our bank manager would no doubt thank Mark for snapping us out of that particular Jedi mind-fog. Hopefully, next week he'll take a skewer to the HTC Vive VR, because our gaze has wandered rather towards that in recent weeks. Suckers? Us? No! We prefer to see it as keeping our youthful exuberance and enthusiasm. Mark probably wouldn't see it like that, though. Bless him.

THIS WEEK'S CROSSWORD

Across

- 7 Victorian English architect and designer best known for his work on the external detail and internal fittings for the Houses of Parliament. (8,5)
8 Having an oblique or slanting direction or position. (6)
9 A unit of information equal to 1000 petabits. (6)
10 Velouté or brown sauce with sautéed chopped onion and dry white wine and sour cream. (7)
12 An ancient unit of length based on the length of the forearm. (5)
14 An imaginary animal used typically with reference to a task or goal that is elusive or impossible to achieve. (5)
16 Amiga computer game developed by Traveller's Tales and published by Psygnosis in 1991. Later it was ported to the Sega Mega Drive as The Legend of Galahad. (7)
19 An earth colour containing ferric oxides; used as a pigment in painting. (6)
20 A hard blow with a flat object. (6)
22 A pattern formed by wave interference, especially one represented in a photograph or diagram. (13)

Down

- 1 A loud, fast-moving, and aggressive form of rock music, popular in the late 1970s. (4)
2 Beat through cleverness or ingenuity. (6)
3 An early artificial intelligence program that solved algebra word problems. It was written in Lisp by Daniel G Bobrow in 1964. (7)
4 What the winners of a series of cricket Test matches between England and Australia get to take home. (5)
5 .tv. TLD. (6)
6 Cause a window to show on screen as a small icon without closing the program. (8)
11 A live streaming app for Facebook. (8)
13 International news agency founded in London in 1851. (7)
15 Process an outline image using colour and shading in order to make it appear solid and three-dimensional. (6)
17 A range of spiritual or religious beliefs and practices that developed in Western nations during the 1970s (3,3)
18 An unintentional act or remark causing embarrassment to its originator. (5)
21 Informal conversation conducted by texting or instant messaging. (4)



In Next Week's Micro Mart*

- The big guide to gaming and performance PC peripherals – mice, keyboards, headset and more!
- How the QWERTY keyboard came to be and its influence today
- Plus the usual mix of news, features, reviews and advice



* May be subject to change

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